THE
ELECTRICAL REVIEW.

VOL. LXIX. NOVEMBER 17, 1911. No. 1,773.

ELECTRICAL REVIEW.

Vol. LXIX.] CONTENTS: November 17, 1911. [No. 1773.

	Page
Corruption	809
An Exhibition Report	810
The I.E.E. Articles	811
Carbon Lamps as Heaters (*illus.*)	812
Correspondence :—	
Electrical Enterprise	812
Thermit Welding	813
The Institution of Electrical Engineers	813
Quartz in Electrical Heaters	815
Proceedings of Institutions :—	
Institution of Electrical Engineers	815
The Present Position of the Electrometallurgy of Iron and Steel	815
Higher Education : Some Views of a Teacher Employer	816
Electricity in Iron and Steel Works	817
Legal	818
New Electrical Devices, Fittings and Plant (*illus.*)	820
Business Notes	820
Recent Developments of the "Schorch" Individual Drive System in English and Colonial Textile Mills (*illus.*)	827
Notes	832
City Notes	835
Stocks and Shares	837
Electric Tramway and Railway Traffic Returns	838
Share List of Electrical Companies	839
Swedish Exports of Electrical Goods	841
Notes on the Insulation Testing of Electrical Machines (*illus.*)	842
The Threatened National Coal Strike	844
Economies in Electric Theatre Working	844
Notes from Canada	845
The Delhi Durbar, 1911	845
Our Legal Query Column	846
The London Opera House Installation (*illus.*)	846
Foreign and Colonial Tariffs on Electrical Goods	848
New Patents Applied For, 1911	848
Abstracts of Published Specifications	848
Contractors' Column	Advertisement pages xxii and xxiv

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEKKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 18s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS. — NEW YORK: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOIVEAU & CHEVILLET, 22, Rue de la Banque. BERLIN: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

CORRUPTION.

A MEETING of the Secret Commission and Bribery Prevention League was held at the Mansion House on October 24th.

In reference to the recent Act, it was admitted that the results were extremely meagre, and that the evil sought to be cured was still rampant and increasing.

We can hardly resist the temptation of saying : "We told you so." Before the Act was passed we pointed out that it would serve as a very convenient cloak. In Russia, where corruption has grown to a luxuriance unsurpassed even in the States, the law against the giving and receiving of bribes is more drastic than in any other country—and the cloak is more effective. Nay, the cloak is now thrown off, and corruption stands naked and unashamed ; the acknowledged master of the destinies of that great Empire.

We pointed out that the great difficulty was not the punishment of the culprit, but his discovery.

The old law was strong enough as regards municipal life, at least ; and yet it was well known that the evil was worse in municipal than in private affairs. We predicted that the Act would lead to the punishment of respectable persons for the most trivial and innocent "tips," while it would fail to expose the blackmailers of commerce. If it were not for the fiat of the Attorney-General, and the common sense of a certain number of people, the Act would jail an archbishop for tipping a guard to delay the train for two seconds to allow his Grace to get in. As a matter of fact, the convictions up to date have been almost all of a most trivial character. On two occasions men have been punished for giving some pence to draymen for carrying messages or parcels to their next place of call. The kind of bribery that was aimed at nas altogether escaped. The Mansion House meeting was convinced that the evil was unchecked and growing. The decision arrived at was to press for an amendment of the law, removing the fiat of the Attorney-General, so that anybody can prosecute anybody else without his sanction.

We deprecate most strongly any such movement. It would be certain to tend to the multiplication of trivial cases against persons who meant no wrong, for ordinary "tips" causing no injury to anybody. We do not believe any genuine actions against bribery have been stayed by the Attorney-General. His fiat is necessary to stop trivial or spiteful prosecutions.

The real trouble is, as we have all along contended, that there are only two parties to the crime and no witnesses ; and the law holds both equally culpable. Therefore, neither the giver nor the receiver will ever tell on the other. Every care is exercised. The bribe passes in coin. The books of both parties appear quite innocent, though, doubtless, the

auditors of many large concerns could a tale unfold. Such items go down to "Trade expenses," or "Travellers' salaries," or "Commission account."

Should the unfortunate traveller who had to pay over the bribe be detected, he would be repudiated with honest scorn by his principal.

Many blackmailers are so sensitive that they must not be directly bribed. For such persons a game of chance or skill with high stakes has to be arranged. Others, again, are so scrupulous that they will not accept anything for themselves. But the blackmailed one is allowed to discover that some female relation has a taste for jewellery. It would be difficult to bring such gifts within the law, but they are pure blackmail none the less.

So many are the tricks and dodges of the blackmailer that we venture to say, as we said before the Act was passed, that so long as both parties to the crime are compelled by the fear of the law to keep silence, so long will discovery or checking of the evil prove impossible.

Isolated cases there will be, no doubt, of a blackmailer who is also a fool; but such cases only serve to make the cloak for the clever ones the more effective.

There is only one way to make this game too dangerous, and that is to let one of the two criminals go scot free. Which is it to be?

The blackmailer is the one who betrays a fiduciary position. He is buying for a client who trusts him to use an unbiased judgment. He accepts a bribe. In nine cases out of ten he asks for it, either directly or indirectly; and he makes it sufficiently clear that by that means only can the seller hope to obtain the order on which, in the long run, his living depends.

We hear a lot about honest buyers being tempted by wicked sellers anxious to part with quantities of gold. Such nonsense may be dismissed. Honest men are not tempted by bribes. They promptly kick the offender downstairs. They have their fixed scale of salary or commission from their employer, no matter whose goods they buy. They are in a strong position, and not at all at the mercy of temptation. But the seller, if he is confronted with a blackmailer, must bribe or starve.

His duty to his employer is to sell. He betrays no trust. An honest seller finds it difficult to exist; and, by the inexorable laws of cause and effect, he will soon become extinct unless a remedy be found. There is only one effective change that can be made in the law, and that is to relieve the seller from all responsibility, and fix the terrors of the law—tooth and nail—upon the dishonest buyer, or the agent who betrays his trust. If that be done, the blackmailer (who is a coward at heart) will go in terror of his life. He will be absolutely at the mercy of the other party, who is sure to use his power to an extreme, and finally to produce an exposure. A quarrel is pretty sure to take place some time, and when that happens the blackmailer will be given away by the blackmailed without compunction.

Other methods should not be neglected; above all the cultivation of a strong and healthy public opinion. The subject should be properly handled as part of the universal educational curriculum, so that the next generation may at least know right from wrong. A leading question should appear in all examination papers; the Institution of Civil Engineers might well lead the way in this. The evil must be torn up by the roots as speedily as possible.

An Exhibition Report.

Was the Olympia Electrical Exhibition a success? What were its merits? What were its failings? What lessons may we learn from the latter? These questions have been widely discussed during the last month, and some of our readers, already aweary of the subject, may wonder why we revert to the matter now, seeing that we have been silent for so many weeks. Our reason is that while all the furies were let loose by other penmen during the excitement of a busy period, and unworthy suggestions were made concerning ourselves, it was in the interests of the Exhibition and the industry that we should bide our time until the storm had spent itself, or, to change the figure, until the birds had beaten themselves to exhaustion against the bars of their cage. Now, calmly and dispassionately, we can review the event and its lessons. Lord Rosebery, in his Chesterfield speech, used the expression in a political connection of certain restive spirits, "Let them blow their trumpets—till they crack their cheeks." Has the remark no aptness in respect of those who strove to rally disaffected forces at Olympia? It is the easiest thing in the world to find fault with something that you have not done yourself. Most people think a thing ought to have been done differently—after the event. It is better to *advise* in good time than be late in the day to *criticise*. Writing editorially about this exhibition as long ago as February 17th, 1911, we said, in reference to the necessity for making the event popular with the public, compelling them to "come and see":—"Probably many of our readers will be able to advance useful suggestions of a dozen or two other ways in which the public shall be attracted, the general electrical trader's interest won, the engineer and architect, the councillor and shareholder, the mansion owner and the cottage dweller, all be made to feel it imperative to see the latest advances in electrical applications. *No doubt any original ideas will be welcomed if submitted in good time.*" We do not know whether our comments in that article were ever considered by the committee or by the management, but we do know that their critics were not in evidence with original ideas when they were invited. Another remark in the same article was:—"A grand success, with record attendances, booming electricity for all we are worth—that is of more importance than the Exhibition Committee being able to show a big profit on the turnover." We might quote many more such remarks as these, made eight months before the event, for the edification of those who said the same things with the air of originality while the show was in full swing or when it was actually ended.

We should not have alluded to the matter now were it not for the fact that a report by the management, submitted to the Executive Committee, has been brought before us as a journal. The criticisms of the Press and of individual exhibitors led them to prepare this report, not merely with a view to showing the impracticability of various suggestions that had been made, and dispelling misunderstandings, but also in order that useful deductions might be drawn from recent experience concerning "certain modifications which might reasonably be adopted when another electrical exhibition takes place." Their report bears date November 6th—that is, several days earlier than one of our most esteemed contemporaries had managed to tabulate collected suggestions and draw conclusions from them.

It was not the fault of the management that there were not more working exhibits of electric driving of the machinery used in various trades. The effort was made to secure the co-operation of engineering firms to this end, but this was refused, as they "would not be recompensed for any outlay to which they were put," their exhibits being suitable for particular trade exhibitions. This is not an unreasonable attitude. It was motors and power we wanted to secure business for at Olympia. The motor makers might have made arrangements with the machinery makers, or better than that, and more fittingly, the supply companies who paraded their good intentions and the fact that they were spending much money, should have completed their scheme and had their large space better occupied by showing the uses of electricity for driving different classes of tools and machinery and domestic apparatus. Was this among the good resolutions that they failed to carry into effect? It is not likely to be forgotten that wherever there were working exhibits there the general public gathered. We have no words strong enough wherewith to condemn the apathy and the misguided policy, the want of business-like co-operation on the part of this co-operative party of supply authorities. They would have done more good had they shown working exhibits than they could hope to do by the display of pretty posters—however artistic. We were all there for business,

not play, not art! But we will leave the supply authorities for the present—the memory of their failure will be keen long enough for us to return profitably to the matter later on. It was in their interests, above all others, that *publicity* should be given to the event, and that the plentiful and early circulation of tickets should be made.

The management state why it was that their efforts to secure a model hospital ward, and a full display of electro-medical apparatus, were not successful, and they also show that free space was not regarded as a sufficient inducement by firms who might have displayed exhibits of electrical horticulture, Röntgen ray apparatus and electro-photographic transmission apparatus. It was not the fault of the management that the attendance was poor during the first week, for in July last all exhibitors and supply authorities within a radius of 80 miles were offered supplies of tickets at reduced rates. Furthermore, the fine weather during that first week was alone a considerable handicap to any indoor event, while in addition there were the open-air attractions of the White City and the Crystal Palace, all of which led London visitors to defer their visits to Olympia to the later weeks.

It may be that the official exhibition advertisements were inadequate to stimulate the public interest, and perhaps they were not attractively designed, but it is also the fact that exhibitors were little inclined to give the Press that advertisement support which, unfortunately, seems to be necessary in order to ensure for an event proper editorial recognition.

The management detail the measures taken by themselves for the ample display of posters everywhere, and they complain of the failure of exhibitors to give them reasonable assistance in this respect. The amount officially spent in advertising the exhibition of 1911 was greatly in excess of that spent on the 1905 show, it being approximately 10 per cent. of the revenue. We agree with the management that, at an exhibition of this kind, where every exhibitor is present primarily for the purpose of his own business, there are real objections to the grouping of competitive exhibits of a like class; furthermore, such an arrangement would involve the goods of larger firms being scattered in a number of places in the Hall. As a matter of fact, the cooking apparatus firms unanimously decided that it would be against their interests to have a collective exhibit. No business man needs to be told the reason for this attitude.

The organising managers contend that almost every practical suggestion that has been advanced by way of criticism had already been anticipated before it was tendered, and, as we have shown above, their conclusions were issued before some of their critics had completed their inquiry. So far as the managers are concerned, the conclusions arrived at as the result of the month's run and the discussions arising out of it, are as follows:—

They hold that, for future electrical exhibitions, the policy recently adopted at Olympia should be modified, first, by the abolition of the half-crown days. We are in the completest agreement possible here, as we have held that view tenaciously from the first. Secondly, they recommend that exhibitors be supplied with tickets in unlimited quantities, "with the liability that all such tickets as reach the management through the turnstiles of the exhibition shall be paid for at the rate of 6d. each. This probably, however, would tend to a reduction of revenue on ticket account." Thirdly, they hold that the duration of the exhibition should be restricted to three, or conceivably two, weeks only. This is specially recommended in view of the small amount of heavy machinery that is exhibited, but it may not meet with general approval. Lastly, they consider that before another Electrical Exhibition is decided upon, definite arrangements should be made with the supply authorities to ascertain exactly the amount of support that they are willing to accord by way of purchase of tickets, it being recommended that for a large Exhibition this purchase of tickets should be not less than 150,000 to 200,000. It is further recommended that the arrangements with the supply authorities should be for the sale to them of tickets outright at 3d. each. "Were arrangements made with the supply authorities that they would be liable to pay for all tickets used at the rate of 6d. each, it is most probable that such a method would considerably curtail a large distribution of tickets, and this for obvious reasons."

We have no desire whatever to silence criticism in respect of exhibitions of this character, but we cannot help feeling that no good end will now be served by a continuance of it in the destructive spirit by the indiscreet champions of a few apparently dissatisfied exhibitors. A good deal of water will have flowed under the bridges before the next Exhibition, and doubtless when the time comes for proceeding with the organising of another display, those responsible will profit by all the good, bad and indifferent advice which has been so plentiful of late.

The I.E.E. Articles.

The intensity of interest aroused among all classes of members of the Institution is well illustrated by the letters appearing in our "Correspondence" columns to-day. It should not be deduced, however, from the criticisms levelled at the proposals of the Council that the latter are necessarily at fault; some of the comments put forward, in fact, can easily be shown to be erroneous.

The parallel-column comparison issued by the Council is not an exhaustive analysis of the changes embodied in the new Articles; for instance, the maximum age limit for Students is specified as 26 years in Article 17, which does not appear in the tabular statement.

The question of representation of each class, too, which was put prominently forward in the discussion, and figures in one of our letters to-day, is attacked upon totally wrong premises. It is assumed quite gratuitously that the three Associates, for example, are to watch over the interests of the Associate class. But theoretically, at least, it is the duty of every member of the Council without exception to act in the interests of every class of member and not of any one class alone. For this reason separate representation of the Student class is unnecessary. A more plausible reason for the introduction of three Associates as members of the Council may be found in the fact that the Associate class in future will be composed of men of wide experience and great ability, and it is obvious that the Council will be greatly strengthened by the inclusion of men selected from this class, for the sake of their advice and assistance.

Perhaps the most difficult question to solve is the designation of the new class, for which the term "Licentiate" was suggested. After long consideration of the matter, we are driven to the conclusion that this title is absolutely inadmissible; the objections to it are insuperable. Despite the use of it by one or two other professional bodies in a similar application, by common usage it connotes the possession of full authority to act as a qualified member of the profession concerned. We know of over a dozen instances in which this is the case. The title is altogether too pretentious for the qualifications it would represent as applied to the new class of members.

The title adopted ought to give some *prima facie* indication of the professional standing of the member; it ought to be of such a nature that he will be impelled to transfer to a higher class of greater dignity at the earliest possible opportunity; and it ought to be such that it does not lend itself readily to misuse. Not one of these qualities attaches to the term "Licentiate."

It is useless to find fault without suggesting a remedy, and having spent some hours in the search for a more appropriate title, we can cordially sympathise with the President's comment on the extreme difficulty of the problem. The only title that we can recommend is that of "Junior Member"; this appears perfectly to fulfil the three desiderata that we have mentioned above, and it is a term already in use for the purpose—for example, the American Society of Civil Engineers employs the term "Junior" for a closely similar class of member, next in order to that of "Associate Member." We see no serious objection to the title, while its advantages are obvious.

The mode of election of the Council, we think, might with advantage be modified by a provision that the list of nominees should always exceed by, say, two names the number of vacancies, so as to render it certain that a ballot shall always be necessary. We believe this would remove most of the objections which have been raised to the system proposed.

D

CARBON LAMPS AS HEATERS.

By DONALD SMEATON MUNRO.

The low candle-power metal-filament lamp for high voltages has arrived at last, and it would seem that the carbon lamp will soon be entirely superseded. Manufacturers, contractors and consumers have among them many thousands of carbon-filament lamps which even now are unprofitable to use for lighting.

The writer suggests that these displaced lamps might be used extensively for electrical heating. The ordinary sizes up to 50 c.p. make very cheap, effective and easily replaced heating elements, and they may be used safely with standard holders.

It will be found, as a rule, more convenient to use obscured lamps, preferably run somewhat under their voltage.

The effective heating surface of five 50-watt pear-shaped lamps is considerably greater than the surface area of the standard 250-watt radiator lamp as ordinarily used.

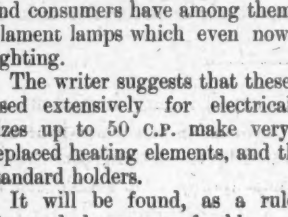


Fig. 1.

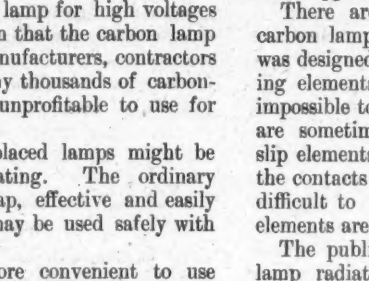


Fig. 2.

As heating energy is generally supplied at low rates, it is necessary to enclose the lamps in such a way as to prevent them giving more than a limited amount of light. This may be done by enclosing groups of lamps in cylinders of coloured glass or in box convectors, the sides or fronts of which may be of special glass or mica.

Carbon lamp convectors may be made of sheet copper so arranged that light does not percolate through the draught ingress and egress. Carbon lamp radio-convectors may be made of finely perforated copper sheeting.

Fig. 1 shows one convenient and cheap form of such a radio-convector which the writer has had made up. Fig. 2 is an inside view, and shows that the central axis is a length of iron tube carrying two brass lampholder spiders. The ends of the tube are screwed so that they may be fixed to stands or brackets by lock nuts.

The lamps are surrounded by a pin-hole perforated copper cylinder about 7 in. diameter × 16 in. long, and two brass end caps hold the cylinder rigidly in position.

As the flexible enters through the central tube, the cylinder is free to revolve; and as a third of the circumference of the cylinder is unperforated, this portion forms a shield or reflector which may be placed at any desired position.

The glow from the perforations has a pleasant sparkling effect which is further improved if a few red lamps are introduced.

When the heater is in use, the inner space becomes at once filled with hot air which pours through the upper pin-holes, and is constantly replaced by air from below.

The lamps are protected from mechanical injury so the apparatus may be applied at the most effective heating positions. Thus the radio-convector may be fitted over a floor ventilator; it may be placed on a window sill, or even screwed to the lower part of a door. The design is suitable for putting under a desk or table, and when large areas are to be warmed, they may be fixed at intervals around the walls or in suitable recesses. A switch or switches may be fitted on one of the brass end caps, but it is more in accord with modern practice to have the switch on the wall beside the socket connector.

When the ordinary carbon lamps become recognised as heating agents, there are many places where they may be utilised with effect.

Long corridors, for instance, which are now ineffectively dealt with by radiators at considerable intervals may be fitted with suitably adapted "Coronation Strip" run along the baseboards and covered in with sheet metal tube. Numerous other applications will suggest themselves.

There are, possibly, some disadvantages in using the carbon lamp for heating—it is not the purpose for which it was designed. But defects are also common to other heating elements. High resistance wire bobbin elements are impossible to repair, they smell in dusty atmospheres, and are sometimes expensive and awkward to replace. Mica slip elements are liable to puncture and short-circuit when the contacts become dirty and loose, and it is sometimes difficult to reach and detach the offending slip. Quartz elements are somewhat fragile.

The public has been more readily attracted by the long lamp radiators than by those of the non-luminous type. The cheerful appearance, and the fact that radiant heat is immediately perceptible by the hand and eye, are factors in the marked popularity of this type of radiator.

The filaments are long and delicate, however, and when placed vertically—as they usually are—they are in the worst position for heating an ascending column of air. Then the current they take is unduly heavy for the standard lampholder.

Some might consider that the use of ordinary pear-shaped lamps would tempt to dishonesty when there is a considerable difference between heating and lighting rates. But one never comes on cases where lighting lamps have been substituted for heating lamps on the existing patterns of open type radiators, and there the substitution could be more readily effected than in the types of closed radio-convectors indicated.

The writer has no wish to belittle the many excellent heaters on the market, but by drawing attention to some of their disadvantages he would, perhaps, show that there is a field for the carbon lamp as a graded heat unit, and it is a flexible, clean and cheap unit which may be applied to many new heating purposes.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electrical Enterprise.

On moving to a new house, I recently sent an application for a service to the electrical supply company for my district. They inform me that as my house is 160 yards from their nearest main, they will require a three years' guarantee of a minimum current consumption. I find, from their own figures, that the total payments would come to very nearly the entire cost of laying the extension cable. The new cable would pass a score of good-class houses, some of which would doubtless take current within a year or two of the main being laid, yet I am expected to pay in three years more than half the cost of a cable which will earn profits for the company for the next 20 years or more.

I refused this noble offer, but eventually signed a guarantee for half the proposed amount, thereby pledging myself to spend on electricity nearly twice as much as I should otherwise spend on coal and gas, and to buy enough current to do all the household lighting, heating and cooking. The supply company state that this will not justify the capital expenditure, so I drop into the arms of the gas people, who sell at 2s. 2d. per thousand (against 5½d. per unit for electricity), and who have sufficient faith in their business to lay mains at their own expense.

A. L. Rawlings.

London, S.W.

Thermit Welding.

We notice that in your remarks on the Municipal Tramways Conference, appearing in your issue dated October 27th, you give the percentage of breakages on Thermit welded joints in Manchester, as *3 per cent.* We would point out that, although this figure appeared in the original proof of Mr. Mattinson's paper, it was corrected at the meeting, and should read "*0·3 per cent.*" *over 7,000 joints.*

As regards the apparent discrepancy between the results obtained at Glasgow and those at Manchester and Leeds, we think the following remarks will explain this.

The welding at Glasgow was carried out by the Corporation's own men, and was done prior to 1908, since when no Thermit welding has been carried out there. As was pointed out by both Mr. Mattinson and Mr. Holt, very decided improvements have since been made in the process, and we now always send our own trained men to do the welding, as it was found that the ordinary platelayer did not do the work with sufficient care.

During the discussion on the paper, Mr. McElroy, the general manager of the Manchester Corporation tramways, attributed the results obtained by them to a great extent to the fact that they now employ our welders.

We could mention a number of systems where we have carried out welding within the last three or four years, where there have been no breakages at all, and we do not think a proper comparison can be made between the results at Glasgow and those at places like Manchester and Leeds, where the process is being carried out on up-to-date lines.

For **Thermit, Ltd.**

R. Stutz,
Managing Director.

London, E.C.,
October 30th, 1911.

The Institution of Electrical Engineers.

Perhaps I may be allowed, as one of those most nearly affected by the proposed creation of the Licentiate class of the Institution, to express my hope that the proposal will be carried through.

Having belonged to the Institution for nine years, I am now nearing the age limit for senior students, and, as I have not yet attained that "position of superior responsibility" which is necessary for an Associate Member, it seemed inevitable that there should be a break in my membership. A man who has had a college training and served an apprenticeship in the shops is hardly out of his time at 24, and it is surely too much to expect in these days of overcrowding that he should at once obtain a position good enough to warrant his election as Associate Member after holding it for two years.

It does not matter whether the new class are called Licentiates or Subscribers, but it does seem desirable that something should be done to prevent those who have belonged for some years to the Institution, and are anxious to continue in it, being turned out owing to their not having attained, at the age of 24, the necessary position for Associate Membership.

F. Fawcett Smith.

Southampton,
November 11th, 1911.

The report of the meeting of the I.E.E. on November 2nd, the letters on the subject of the Articles of the Institution in your columns, and your own comments, indicate how sincerely those who have the welfare of the Institution at heart are striving to find the best method of improving its status and scope. But while the claims of Members, Associate Members, and of those gentlemen to be included in the proposed classes of Associates and Licentiates are being considered, permit me to point out that nowhere in print or speech is any reference made to the position of the Students under these altered Articles.

The Student class, I make bold to say, is the most truly representative of the Institution, for all its members are electrical engineers *in esse* or *in posse*. They are the rising generation of the I.E.E., and as such will be more nearly affected by the proposed alterations than the other classes. Yet no notice of proposed alterations has been posted to the Students, no one has voiced their claims and grievances, and it is to be presumed that the majority of the 1,800 Students are quite unacquainted with the details of the alterations. I trust, Sir, that you will kindly give publicity to this letter in your columns, to indicate to Students certain points in the new articles, and to appeal for immediate concerted action to obtain necessary amendments. Practical assistance can be given by the calling of special Students' Section (local) meetings, written support to local secretaries, and by letters to the Council and to the electrical Press.

Turning to the proposed alterations, the first important point is the qualification of a Student. The old Article 16 established a maximum age limit. This has been omitted from the new Article 16, but the old one should be re-inserted.

Altered Article 16 Sec. *(b)* states that as an alternative qualification the candidate must be "pupil, apprentice or assistant under agreement under a corporate member." To this should be added "or pupil or apprentice to any approved firm of electrical engineers, approved supply company or municipal undertaking," and the words "under agreement" should be deleted. Reasons: First, there are many eminent firms who do not make such agreements with pupils, and, further, one such firm has at the present moment only one corporate member (who takes no active part in the business) but 20 Students on the staff. Of these 20, approximately 12 are apprentices; are then these Students to be disqualified? Their case is not covered as the Article stands without my proposed amendment.

With the examination for transfer we all agree, but as grounds for exemption should be inserted the obtaining of a Student Premium or the acceptance of a paper or original communication for publication in the *Journal*.

We must next consider the question of subscription. It is proposed to increase this to 1½ guineas for Students over 19 years of age. Why this distinction? What greater advantage is he to gain than his younger colleague? The Student of 21 is usually just beginning to be self-supporting on a meagre income, and is much less able to pay than the younger one supported by his parents.

Students can only agree without protest to an increased subscription all round if they can obtain the concessions for which they have long pleaded, and of which they stand in urgent need, viz., the publication of Student papers; increased allowances for printing and clerical expenses; refreshments after meetings; subsidies for long-distance visits; a free lending library; and payment of Student delegates' expenses. When it is remembered that an increase of half-a-guinea all round raises £900 extra, these claims can easily be met.

We must, however, protest strongly against the increased transfer fee, as this, with the examination fee, imposes a double increase of contribution. As this entrance fee increase cannot bring in more than £150 per annum in a total of £4,500 proposed increase of income, is it commensurate with the extra individual burden on the most poorly paid of the profession?

By Article 27 Associate Members on the register as such prior to December 31st, 1911, pay 2½ guineas, those on the register after that date paying 3 guineas. I suggest the addition of the words, "Associate Members on the register of that class prior to December 31st, 1912, and who were on the register as Students on January 1st, 1912, to pay annually 2½ guineas." (Or, if the maximum subscriptions be reduced from 3 to 2½ guineas, then this class to pay 2 guineas.)

My reason is that there are many like myself just about to apply for transfer to the A.M.I.E.E. class; if we can be transferred this year, our perpetual subscription as A.M. is one half-guinea less than if we transfer later. But it gives us no time to obtain the necessary signatures and for our

application to take the prescribed course before the end of this year.

Finally (and these points all support my statement), the Council are out of touch with the Students, and I therefore propose that if it is not possible to be incorporated in Articles 44 or 49, it be entered as a minute of the Council "that three Student delegates (non-voting) be appointed, to be called in conference with the Council when any matter affecting the Students is to be discussed, and that these delegates may request the Council to put such matter on the Agenda."

I appeal to all Students to unite heartily in the present endeavour to improve the status, the utility and the benefits of the "Students' Section," and thereby assist the Council in their desire to promote the welfare of the Institution.

Adolf R. Stelling, *Student I.E.E.*

Manchester, *November 11th*, 1911.

[The maximum age limit is still included, having been placed in a separate Article.—Eds. E.R.]

The proposed new rules have provoked considerable criticism from every class of membership except the one which they most nearly affect, namely, the Students. This is accounted for by the fact that in accordance with precedent—that word which has always been the curse of the I.E.E.—the Council omitted to circularise the Student members, who, like children, are supposed to be seen (and pay) but not heard. As no effective machinery exists within the constitution of the I.E.E. by which Students can in person impress their point of view, it is only possible to air grievances by breaking out occasionally in print. Knowing the Council's dislike of newspaper criticism, this, one would think, should stir them to action, but no—instead, they continue on their way, marking their elevation, in Emerson's words, chiefly by the innocent serenity, which, with babe-like Jupiters, they sit in their clouds and from age to age prattle to each other and to no contemporary, heeding not the petitions and complaints of those they represent or more truly do not represent, and consequently the position of I.E.E. Students is not improved.

The patience even of Students is limited, and the action of the Council in bringing forward the new rules in their present form is calculated rather to lead to wholesale resignations than to transfers.

Consider the position of the Student member. To ever get into the I.E.E. as a Student, it is necessary that the candidate should have electrical knowledge, and be in effect engaged in studying electrical engineering as a profession. Under the existing rules Studentship is the only rank for which definite qualifications as opposed to mere eminence are required. The very fact of a man joining as a Student means that he is making electrical engineering his life's work, and will ultimately pass into the higher grades. Therefore, whatever tends to alter the conditions of membership of these higher grades, or entrance into them, or the general status of membership of the I.E.E., affects him more acutely than it does any other class, and consequently calls for his most careful consideration. Therefore, in my opinion, although we Students are even under the present rules outside the constitution, we owe no apology to anyone for entering this discussion on terms of absolute equality with the members of those other grades which we shall in time enter.

Their interests are our interests, and our interests should be theirs; we will help them—let them help us.

To go through every point in the proposed rules which affects the Student would necessitate a special number of this paper. Briefly, the more important principles (apart from the question of rewording and extending most of the clauses) are the following:—

1. The division of membership into grades, and the designations of these various grades.
2. The qualifications for each grade.
3. Transfer from lower grades to higher grades.
4. Entrance fees and subscriptions.
5. Constitution of the Council, and the method of its election.
6. Voting powers of all grades.

I hope every Student will obtain a copy of the new rules and, after carefully considering their present and future effect on Student members, will make known his views by writing to his representative members on the local Students' Committees at London, Manchester and Glasgow; to the Committee of his local senior Section; and also by letters to the Press and to the Council.

There is no time to be lost; the matter must receive immediate consideration, and amendments to the various clauses must be sent in without delay. Collective effort is being made in one centre at least, but members must not wait for this; their individual action will strengthen, not weaken, the efforts of their committees.

Among the points which call for mention is the question of minimum age limit. This condition, when tacked on to the qualifications, becomes absurd, and has given rise to difficulties before now. If the qualifications are satisfied, what has age to do with it?

The admission of non-electrical people, however eminent, to the highest class of membership will not add to the status of membership, nor does it help to make it clearer that every Member is warranted to be an electrical engineer, as Mr. Hammond seems to think it does. These eminent persons should be given a class by themselves, on the same plane as regards rights and subscriptions as full electrical Members, but distinguished from them by name. For this class, the name of "Honorary Associates" seems quite suitable.

The name of Licentiate is particularly unfortunate, as, in spite of dictionary definitions, it is associated in the public mind with permission to practise a profession, which, I take it, a "Licentiate I.E.E." is distinctly unqualified to do.

One cannot congratulate the Articles Committee or the Council on the new rules. If this is the result of 18 months' hatching, something must be very addled.

Mr. Hammond seems to think that the dignity of membership in the I.E.E. is conferred by the possession of a certain building; this is perhaps so, the I.E.E. has never done very much good for its members. The line of argument which he adopts, however, is ridiculous, and is really equivalent to saying that if Mr. Hammond owned a stable he would be a horse.

If the members had been given reasonable time to reflect, they possibly would never have committed themselves to a scheme which is beyond the resources of the Institution. The increased expenditure in the way of using more of the building, seems to be a sort of attempt by the I.E.E. to become its own tenant.

The Council are granting the use of the Institution building to 13 other bodies; it is to be hoped that rent is being paid for this. It is all very well to be hospitable when the resources allow it, but not otherwise, and there is no sort of obligation on the part of the I.E.E. to act as fairy godmother to the electrical industry.

Mr. Hammond gives a comparison showing how economically the I.E.E. manage compared with other institutions, but no mention is made of rent or upkeep of buildings. This item would show where the trouble lies, and would expose the penny-wise and pound-foolish policy of our Institution. Even if the increased subscriptions go through, the extra benefits will not be of much use to country members. Why should these men pay three times as much for their Local Section meetings, simply because of being in the I.E.E.? Membership is not worth it now, and certainly will not be under the new rules.

What I.E.E. members want for their money is not expensive buildings, but personal and professional advantages.

In conclusion, let me once more ask all Students to take effective means at once to secure the complete revision of the proposed rules.

H. Ambrose Carney.

Nutsford Vale Works, Manchester,
November 11th, 1911.

[The Institution cannot demand rent from societies to which its rooms are lent, as in that case it would become liable to very heavy taxation. We believe, however, that all expenses for lighting and heating, &c., are defrayed by these societies.—Eds. E.R.]

Quartz in Electrical Heaters.

Referring to Mr. C. O. Bastian's letter on this subject in your current issue, we beg to assure this gentleman that his remarks concerning his electrical heaters do not interest or appeal to us in any way. A correspondent put forward a claim for Mr. Bastian to be considered as the first to use quartz for electrical heating purposes, and we pointed out that this claim could not be sustained in view of the fact that this material had been used for the purpose for a number of years. We have quoted a few of the better-known firms using the material, and there is no question of their non-existence or non-use of the material, notwithstanding anything to the contrary that Mr. Bastian may say. We are sorry to learn that Mr. Bastian has not met anyone who has seen quartz used except for laboratory purposes; but this is his misfortune, which can, no doubt, be easily remedied if he chooses, probably with advantage to himself. It is probable that quartz apparatus, as manufactured by other firms, differs from that designed by Mr. Bastian, but we mentioned these points of difference in our letter contained in your issue of October 6th. The oldest application of quartz to electrical heating purposes, and that employing the largest units, that we are acquainted with, is in the construction of electrical furnaces intended for the purpose of hardening steel tools, drills and dies, &c., in which a quartz muffle or tube is used, working at a temperature of 2,500° F., and consuming from 600 watts to 15 KW. We are not aware that these are used in laboratories; they find their largest application in engineering works, &c.; we have also supplied them for the manufacture of artificial teeth. This, of course, constitutes merely a single instance; there are also numerous others applicable to domestic and ordinary commercial purposes.

Paterson & Co.

Newcastle-on-Tyne, *November 13th*, 1911.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers.

This year's opening meeting of the session was somewhat exceptional, in that the presidential address was omitted, Mr. Ferranti continuing in the office the duties of which he so ably performed during the last session.

As usual, the early part of the evening was given up to the distribution of the premiums, exhibitions, &c., awarded in connection with the last session's papers, a list of which appeared in our issue of June 2nd.

The attendance was rather smaller than on similar occasions, and the absentees among those who should have been present to receive the awards were numerous.

At the close of the distribution, the first paper of the session was read by Mr. J. F. C. Snell, in the absence of the author, Mr. Wm. T. Taylor. We shall publish an abstract of the paper in our next issue.

The Present Position of the Electrometallurgy of Iron and Steel.

The last two meetings of the Faraday Society, held on October 3rd and 17th, were devoted to the consideration of three papers dealing with different aspects of the electric smelting of iron and steel. On both occasions Mr. F. W. Harbord, one of the Vice-Presidents, presided over what proved to be most instructive meetings.

The paper by Mr. Donald F. Campbell surveyed the subject from quite a general standpoint, although, as was to be expected from an engineer so closely associated with M. Héroult, he laid special stress on the achievements of the Héroult furnace, which, indeed, is now making remarkable strides, both in Europe and America. One of the principal factors on which depends the success of electric smelting is, of course, the cost of power, but it is a great mistake to suppose, as so many do, that it is the only factor of importance. The substitution of electric smelting of the ore for the blast furnace method of direct recovery of iron or steel is, for example, a proposition that would have not the slightest chance of success in countries like England or Germany, no matter how cheaply power could be generated. In Sweden, however, and the Pacific Coast of America, where water power is plentiful, coking coal scarce or absent, and timber for charcoal abundant, the electric furnace enables iron smelting to be carried out with complete success, and the next few years will doubtless witness a development of the iron industries in the afore-mentioned countries that will prove to be of the greatest interest and importance. In Sweden such smelting operations are being carried on at Trollhättan, where a 50,000-H.P. plant has been installed, and at Dömnarvet, while in California there are the 2,000-KW. furnaces at Héroult. In both countries large deposits of very pure iron ore are available, and so long as electrical energy can be obtained for less than 33s. per KW.-year in Sweden, and 50s. per KW.-year in California, iron can be smelted electrically with an adequate margin of profit.

The refining of steel electrically is altogether a different problem from the smelting of iron. Here the cost of power is not the governing factor, and countries like England and Germany, where the manufacture of iron and steel by present methods is an established industry, have nevertheless much to gain by the adoption of the electric furnace, as at least an adjunct to existing plant. It may be noted that the world's output of electrically refined steel has risen from 30,000 tons in 1908 to 120,000 tons in 1910. The assured future of the electric steel furnace depends on its remarkable refining properties, brought about by the great heat easily attained. On this account, pure steel of excellent quality can be obtained from quite inferior ores, even under normal conditions in England, where power may cost anything from 0·4d. to 0·65d. per KW.-hour. The power consumption has been reduced during the past two or three years, by continuous improvements in details of furnace construction, from 750 units to 575 units per ton, equivalent to only some 24s. a ton with power at ½d. a unit, while the difficulties which once ruled as regards obtaining satisfactory electrodes have now according to Mr. Campbell, almost entirely disappeared.

For the manufacture of the best steels, the future will probably be entirely with the electric furnace, but will it, used in conjunction with the Bessemer converter, ever be able to compete generally with the open-hearth furnace for ordinary grades of constructional or rail steel? This problem is now receiving careful attention at the hands of American and German engineers, and several 20-ton furnaces are being erected to prove the economic possibility of the duplex process. The harvest for the electrical engineer in this direction may be a very great one, for in Germany alone 250,000 KW. would be absorbed by the steel maker.

Mr. John Harden's paper described the "Paragon" electric furnace, and dealt generally with the present position of the induction furnace. It will be remembered that the original Kjellin induction furnace was a melting furnace pure and simple, and was only of use for the purpose of obtaining pure steel from the purest scrap or Swedish charcoal iron. The small slag surface and comparatively low slag temperature precluded refining from taking place. The first step in advance was illustrated by the Roechling-Rodenhauser furnace, in which side electrodes were introduced, and the steel heated on the resistance principle, as well as inductively. For refining to take place most effectively, however, it is necessary to heat the slag to a very high temperature, and therefore in the "Paragon" furnace, the surface of the slag is heated by means of arcs. In this way the maximum heat can be applied exactly where desired during desulphurisation and dephosphorisation to the slag, and during the degasification of the steel through the body of the metal by means of the current entering the side electrodes or, if preferred, inductively. The furnace is thus a combined arc and resistance or arc and induction furnace. Why, then, not have arcs only, and do away with the resistance and induction principles entirely? Mr. Härdén contends that on the one hand smaller electrode consumption, and, on the other, a higher power factor, render the combination furnace an advance over either method used separately. The discussion brought forth a considerable amount of technical criticism which centred around the efficacy of the side-electrodes, but experience alone can be the ultimate judge as the value of a device of this kind, which has much to commend it on the surface.

Mr. Harden also described a small melting furnace known as the "Helberger," which is suitable for making special alloys on a small scale for laboratory work. It consists of an ordinary high grade plumbago crucible, lined with refractory material and heated electrically by induction. Temperatures up to 3,000° C. have been obtained in it quickly and at moderate cost, and it ought to find a wide sphere of usefulness in up-to-date works' laboratories.

Mr. E. Kilburn Scott gave a short description, and opened a somewhat lively discussion on the "Hering" pinch effect furnace. This ingenious furnace has already been described in the English periodicals, but its essential features may be briefly recapitulated. The "pinch effect" is the name given to the contraction—electromagnetic in character—of a liquid conductor through which a heavy current is passing. Mr. Hering uses this effect to bring about rapid circulation in the molten mass of an electric furnace. The current enters and leaves the bottom of the furnace through vertical metallic electrodes contained in resister tubes, made of magnetite or alundum, which are very small compared with the bulk of the furnace. The "pinch effect" operating in these tubes, a vigorous fountain-like circulation of the molten mass takes place above and around the resister tubes, on account of their lower ends being closed by the electrodes. So vigorous is the stirring that heat is thereby transferred from the resister tubes to the whole of the charge above.

The main advantage claimed for the furnace is its inherent simplicity. Any open-hearth furnace can be transformed into a Hering furnace by merely inserting resister tubes in its bottom, and the electrodes being made of metal, the difficulties of carbon electrodes do not arise. To obtain the high currents at low voltage necessary to operate the furnace, Mr. Scott recommended the use of the homopolar machine, a new form of which was to be seen at the recent Electrical Exhibition at Olympia.

From some further particulars communicated to the meeting by

Mr. Hering himself, it appears that a number of small experimental furnaces have been built for trying various metallurgical processes, and in these satisfactory results had been obtained. Steel had easily been melted, and no difficulties were anticipated when they came to work the furnaces of 1-5-ton capacities now under construction. The proper proportioning of the resister tubes had involved the determination of the electrical resistivities of iron, steel and ferro-alloys at high temperatures, and the necessary data had now been obtained.

The furnace, though admired for its ingenuity, was subjected to some severe handling, academic be it admitted, in the course of the discussion. The resister tubes at the bottom of the furnace in particular gave rise to expressions of grave misgiving, particularly as they, or rather the electrodes in them, had to be water-cooled. Further, the circulation of the metal through the tubes would wear them away, and once enlarged to any extent, the calculated current would not flow through the furnace. A serious difficulty would arise with direct currents, if the tubes became conductive at high temperatures. Mr. Scott replied that the danger of water-cooled electrodes had been greatly exaggerated, and most of the criticism passed applied equally to the tuyeres of a Bessemer converter. Experience on a small scale, at least, had not given rise to the troubles anticipated, and anyhow the construction of large furnaces was being proceeded with.

Higher Education: Some Views of a Teacher Employer.

By W. Cramp, M.I.E.E.

(*Abstract of Chairman's address delivered to the* Institution of Electrical Engineers, *at Manchester, October 27th*, 1911.)

Everyone of us must at some period have asked himself the question—"What sort of higher education is best?" It is largely because I know that both technical schools and Universities are now turning out men useless to employers, that I have ventured to deal with this urgent matter.

At the outset it is well to clear the ground by defining what we intend to consider. Spencer has given a well-known classification of the kinds of activity which constitute human life. Of his divisions, I take three as involved in the education to be given at a College or University, viz.:—

1. Those activities which, by securing the necessaries of life, indirectly minister to self-preservation.
2. Those activities which are involved in the maintenance of proper social and political relations.
3. Those miscellaneous activities which fill up the leisure part of life, devoted to the gratification of the tastes and feelings.

It seems to me that in a modern college the tendency is to forget the second and third divisions in laying stress on the first. Is it not exactly in this that the older Universities differ from the modern educational institutions?

If you agree, then, as to the necessity for attention to all three divisions of human activity, we are at once faced with an exceedingly awkward problem. It has been proved to the hilt that acquaintance with science (*i.e.*, with co-ordinated and rational knowledge) is of fundamental importance. Recognition of this fact has led to that extraordinary educational revolution which, by replacing one or two old subjects and adding a host of new ones, has rendered all courses from the elementary school to the University intolerably superficial and unsatisfactory. Yet this congestion is due to a consideration of the first division of our subject only. How, then, is it possible for us to add two more sections without producing more congestion and superficiality?

The true responsibility for the revolution is to be laid at the door of the old school, which was pioneered by Huxley and Spencer. They were, without doubt, right in principle, but their doctrines have been carried too far, with the result which we lament to-day. Without denying the value of that sort of knowledge upon which the Huxley-Spencer school set such store, we must so limit it in quantity and order it in quality that it shall take its proper place in the first of the three sections, leaving appropriate time for all that is included in the other two.

This, I think, may be compassed by keeping in view two main objects. The first is the co-ordination and arrangement of the various paths leading from the infant school to the finishing school or university. The second is the proper planning of higher education, so that it is correlated with the succeeding paths in life.

In a letter to me from the late Prof. Ayrton, dated April 19th, 1902, he says:—"The great difficulty about the third-year men's training is our not knowing what branch of electrical engineering they are going to take up."

Precisely, and even if this were always known, it would not follow that it was the branch they were going to stick to. As an employer, the first fault that I have to find with my own students is the narrowness of their field of vision—the inflexibility and too great specialisation of their knowledge. Employers do not want men who can only do one thing properly. I am asking that every man who leaves a technical college shall possess, first, a wider scientific knowledge; and, secondly, wider general culture. Thus only can they obtain, with ripened experience, that greatest asset to the community—sound judgment in all things. And now, if I go back from my position as employer for a moment, and consider myself again in the position of teacher, I ask myself, first, what is lacking from higher education at the present day; and, secondly, how can that want be supplied? As an answer to the first question I submit:—

First, that higher education in practice, if not in theory, aims at producing a finished and specialised animal instead of a plastic, well-informed and broad-minded man. It aims at producing a sort of industrial bee instead of a rational being. It is no more possible to produce a useful specialist in turbines, wireless telegraphy, or any other branch of engineering at the age of 22, than it is to produce a first-rate brain, ear or eye specialist. The very idea of the latter would be regarded as ludicrous, but the former is always expected. At the age mentioned we ought hardly to expect even such elementary differentiation as distinguishes between electrical and mechanical engineers.

All specialisation should, I think, be provided for later, either by higher University training or by experience in the ordinary walks of life. Think how such a change in the curricula would simplify the whole problem of education! It would relieve the tension in primary and secondary schools enormously. It would produce the type of men that we, as employers, really require, and it is the only way, in my opinion, of providing time for all the training which is to produce greater "width of field of consciousness."

Such a reform would fit in perfectly with the scheme of education proposed by Dr. Pohl, for it would standardise a general curriculum in all technical schools and colleges throughout the country for the first three years of training, while higher training than this could be given at scholarship-aided centres.

The scheme also fits in well with the dovetailing between manufacturers and training colleges, recently discussed at the meeting of the I.C.E. Let us suppose the varieties of training divided according to the general professions to which they are intended to lead, and during the ordinary three years of higher education let no specialisation by further sub-division be permitted.

There is, as far as each general course is concerned, no necessity whatever to distinguish between so-called "pure" and "technical"; thus will one of the greatest modern bugbears be abolished. I refer to the stupid rivalry between the so-called theoretical and practical men.

The general course corresponding to each profession should be arranged so as to cover Spencer's three divisions. There would thus be in each case training in:—

1. The science appropriate to the profession.
2. Social and political and commercial relationships.
3. Language, literature and art.

Each division should have its appropriate manual training and practical work.

Section I.—This is the one section at present considered by day colleges. It should be generalised and broadened; I think that can be done by fusion, simultaneous teaching and correlation of all the usual subjects.

All knowledge is correlative, that is to say, we know only and learn only by reference to impressions and sensations already received and labelled. This immediately suggests analogy as one of the easiest ways of learning, one of the most interesting methods of teaching, and one that is likely to lead to the greatest width of consciousness if properly applied.

All the while the student, in whatever region of science he is working, is always measuring, always interpreting one physical phenomenon in terms of another. For him knowledge is an harmonious whole. This is the very ideal of the teaching of science; that there shall be no watertight compartments—no separate "subjects."

The aristocratic exclusiveness of the "professor" must go, the democratic communion of the philosopher must supervene.

Section II.—We turn now to the second section of my proposed general course, which I have termed "training in social, political and commercial relationships." I regard any well-regulated function at which student rubs shoulder with student under conditions of control, voluntarily imposed and maintained by the students themselves, as practical work in this section. It is this section that produces manliness (so woefully lacking in many technical schools). It is this section which distinguishes the older from the more modern Universities. But the older Universities fail grievously in one direction, for while they develop manliness, they also develop (towards outsiders) that collection of characteristics called "side."

While the common life at the University is to some extent restricted and narrow, in another sense it is very wide and free. It is a thousand pities that the consensus of opinion which forms the limit of the free path of the University atom in certain directions allows of and even encourages so much laxity. Anyone who has talked intimately with Oxford or Cambridge men must have been amazed at the toleration, and even approval, of loose morals and easy living countenanced at those Universities; countenanced, of course, so long as certain trivial social canons are not broken.

In another matter the width and freedom accorded to these undergraduates is extremely salutary, as, for instance, the division between work and play. The problem, then, is how to retain the advantages of a non-residential college while adding the beneficial effect of—

1. Freedom of action and individual responsibility (competition).
2. Corporate life and social responsibility (co-operation).

I suggest that in ordinary day colleges and technical schools the first of these must be encouraged by the provision of a principal and staff who are, in the best sense of the words, men and gentlemen.

Yet in the selection of a college staff, how little notice is taken of these things; still, either a University degree or original work is the chief reason for the selection of a teacher.

I believe it to be absolutely essential for the student to feel that every member of the staff is utterly incapable of a mean or dishonourable action. Next in importance to choice of staff is confidence in the student, which must be shown by omission of unnecessary register signing, checking of hours, insistence on attendance and general shepherding.

To produce useful men for us employers, the fullest scope should be given to confidence in the individual, in order to foster the idea of individual responsibility.

Directly connected with the individual responsibility is that supple quality "initiative," than which none is more useful to employer and employed. It is a quality that cannot be really inculcated, but it may very easily be inhibited. What wonder is it that, within the cold confines of public school and University, with their "good form" and set expressions, this glorious quality sickens and soon dies?

What shall we do, then, to be saved? One thing only, it would seem, is of any avail. Remove from the University course every influence that can stunt the mind. Give width and play and freedom to every legitimate learning, and you shall see the initiative of the child blossom again in the man. Encourage suggestions, questions, modes of proof, independent reading and thought.

If some scheme involving effort on the part of the student to enable him to retain his opportunities could be devised for our colleges, we need never bewail the loss of initiative. I suggest, as a possible plan for engineers, that each year they should be required to have earned a stipulated part of their school fees by work in a recognised trade or shop. These fees might under a systematised arrangement with the employers be paid exactly as wages, but in metal checks, which would be honoured by the local technical school or University.

Corporate life and social responsibility is a less difficult matter to deal with. How it is gradually inculcated at the older Universities is very well known.

There is a well-graded community of interest in all manner of matters, allied but separate from the actual degree course. Undergraduates must willy nilly in a thousand ways be brought into contact with lines of thought distinct from their own special course. It is this which gives to the thoughtful man breadth and culture; it is this which we must in the newer universities replace and amplify. Those desirable results (directly due to residence) we must provide for in other ways, chief of which are in the University Union and the Athetic Union. This section is to be common to all the students, and therefore the artificial barrier now existing between men taking different courses would naturally be destroyed and a healthy interchange of opinions would result. In this section there remains still a most difficult side of social education to be dealt with. I mean the moral side. For employers it is essential, if business morality is not to fall to the low level of some of our Continental neighbours, that their employés shall be capable of acting even against strong temptation upon sound principles. Now in a non-residential college, "atmosphere" is almost out of the question, yet "tone" and a proper attribute of mind towards life in general must be somehow imparted. In this connection it is significant that in all the stages of Japanese education "morals" come first. In Western education they are hardly mentioned, except in a whisper. The first care must be as regards the choice and training of the teaching staff, through whose influence and example most of the effect will be most naturally produced. Here then again is an argument for the most rigid care in the selection of teachers, and for the most ample provision of opportunities for intercourse between students and staff.

Section III.—Of those activities which fill up, or should fill up, the leisure part of life, I have already mentioned some in Section II. Indeed, it is very hard to separate these two divisions. How can a love for, and an interest in Nature, literature and the fine arts be stimulated in the college student? The answer is very much as before—by the influence of great teachers acting upon a mass of colliding minds. I can see no other way. To an intelligent teacher opportunities occur almost daily of developing similar sensibilities. I do not see why even the colouring of a scientific diagram should be allowed to be crude, and there are many instances where artistic feeling has incidentally a very real commercial value. To electrical engineers the familiar instances of arc lamps, fittings, and even the shape of motors, will occur at once. In this section, perhaps more than in any other, the effect of breaking down the division between students preparing for different professions would be felt.

To sum up, then, I may give my answer to that question with which I began in a very short form.

The best higher education is that which prepares best for those three great kinds of activity which I have selected from Spencer's five.

The means for carrying this out are in my opinion these:—

1. The division of Technical Colleges and Universities into two sections, viz., the General and Specialised.

2. The arrangement of a course suitable for each of the five great professions at every "general" school.

3. The course for each profession is to embrace training in the three sections, which correspond to the three forms of activity.

4. In order to give time for all three sections and to inculcate general principles thoroughly, the first section (which now occupies all the time) should be taught as broadly as possible.

5. As but few of the colleges can be residential, the second and third sections, which embrace social and æsthetic activities, must be specially provided for.

6. This special provision would take the form of (*a*) a most carefully selected principal and staff; (*b*) avoidance of unnecessary restraint; (*c*) an arrangement by which the student should know that he was dependent upon his own efforts to remain at college; (*d*) proper opportunities for social intercourse, not only between student and student, but also between staff and student; (*e*) definite official encouragement of University unions, literary and debating societies, and æsthetic and athletic clubs.

I believe that even a day college organised on these lines would produce the man who is needed by the world and valued by employers. For it seems to me that for the provision of such general training there is nothing indeed lacking, but the will to organise, for the buildings and equipment exist, and the money is at hand.

The employer is crying out for men of bigger character and broader mind, and the parent is wondering why his son is an engineer but not a man.

We have, in fact, followed too far into a deep and narrow valley, the "Will o' the Wisp" of industrial Science "subjects." The descent was easy, to retrace our footsteps is impossible, but to climb again to the upper air where we may breathe again with more freedom *hic labor hoc opus est.*

Electricity in Iron and Steel Works.

By Walter Dixon, M.I.M.E., M.I.E.E.

(*Abstract of Presidential Address to the* West of Scotland Iron and Steel Institute, *October 20th*, 1911.)

The past 10 years have witnessed great developments in the power installations of iron and steel works, and great advances have been made since the time when economies in fuel consumption had to be first seriously thought about. Of late years attention to fuel consumption has ofttimes secured remarkable results.

One of the first and important incentives to steam saving in isolated engines occurred when it was found possible to transmit power electrically over large areas. Since that time electricity for motive purposes has become more or less universal in all auxiliary plant, the power for which has been generated in the steel works themselves, or, in some districts taken from a public supply.

So far as our own district is concerned, the electrification of works has hitherto been confined to what may be termed auxiliary plant, and, so far as rolling mills are concerned, has, up to now, only been applied in the case of the continuous running sheet and bar mills. Electricity, as applied to reversing rolling mills, with one or two exceptional cases, has not been adopted in this country, notwithstanding its extensive and largely extending adoption on the Continent. Such mills have been in use for four or five years, during which time, I believe, there has not been recorded any serious charge against them, and there are no adequate grounds for supposing that the maintenance and life of a properly designed electrical equipment will not compare favourably with steam driving.

In one sense the matter has been surrounded with difficulties, inasmuch as, while it is possible, owing to the easy and accurate methods by which electricity can be measured, to state exactly what power is required for any particular process or part of a process, no such record is possible with steam plant.

It was in our own district, in the year 1896, that blast-furnace gases were first utilised in a gas engine by the late Mr. James Riley in conjunction with the late Mr. B. H. Thwaite, with which installation and experiments I was concerned. The plant, though on a small scale, was entirely successful, but advance in this country was slow, for one, amongst other reasons, *i.e.*, that while, at that time, the possibilities were seen and appreciated, our leading gas-engine makers, notwithstanding all the inducements which were put before them, were not disposed to develop a large gas engine—a decision which some of them have lived to regret. Almost simultaneously with these experiments, the idea was being taken up by the Cockerill Co., of Seraing, with Mons. A. Greiner, who also saw the possibilities, and were prepared to, and did, themselves develop the necessary plant. It was owing, to a large extent, to this pioneer work being done by the Cockerill Co., that our British ironmasters were willing just to watch developments, though a further fact must be mentioned, viz., that many of the steel works had no blast furnaces, while many of the blast furnaces had no steel works connected with them, and this fact had a more general application to Scotland than to England.

It is now recognised that blast-furnace gases used in gas engines can develop not less than twice the power which can be developed in steam engines using gas-fired boilers.

Abroad, blast furnaces are generally associated with steel and other works requiring power, and the rapid increase in the number of gas engines now employed on blast-furnace gases shows to what extent the possibilities have been recognised and taken advantage of.

Statistics published in the *Iron and Coal Trades' Review* show the distribution amongst various countries of 1,033,509 B.H.P. of large gas engines, as follows:—

	B.H.P.	*Per cent.*
Germany	480,428	46·5
America	337,490	32·5
France	55,050	5·4
Belgium	46,714	4·6
Austria-Hungary	25,500	2·4
Great Britain	24,986	2·4
Other countries	63,341	6·2

This power has been used in the various industries, as follows:—

	B.H.P.	*Per cent.*
Iron and steel works ...	855,819	84
Collieries	68,200	6
Electricity works	34,950	3
Other works	74,540	7

The advent of the electrically-driven reversing rolling mill, bringing, as it did, the possibility of practically dispensing with steam, at once opened up the way for a large economy, by the practical elimination of the boiler range, and utilising the available gases to the full. This is, in my opinion, the reason of the advance in the adoption of the gas engine on the Continent and in America, and it remains for us to consider how far our own industry can be put on a similar basis.

A steel works cannot safely depend on a large and regular supply of power where only two or three blast furnaces are in use, the working of the furnaces not being sufficiently regular, nor the gas sufficiently constant, either in quality or quantity. These difficulties could, to a large extent, be got over by the introduction of a comparatively inexpensive gas-producer plant acting as a stand-by. Gas has replaced steam in a few works in this country, and the idea that such projects are economical has been confirmed.

Steel makers abroad have their power, practically speaking, for nothing, while, in many of our own works, almost every horse-power must be developed by the actual utilisation of coal in steam boilers. The time has surely gone by when a British steel maker should hesitate to get his power generated by gas engines. Too many works now successfully depend on such engines to warrant any hesitation, and it may now be taken as a fact that a properly equipped gas engine station, on modern lines, is as dependable as any other type of station, and the power can be obtained by this method for, let us say, one-half the coal that is being expended at the present time where boiler firing is resorted to.

Gas engines up to 5,000 H.P. can now be obtained to give out 1 H.P. for about 1¼ lb. of coal, which coal can be gasified in producers of simple and inexpensive type. Gas either used in gas engines direct coupled to mills, or used for electrical generation by means of gas engines, can be far more economically employed than the more or less arbitrary method of boiler firing, where large steam reserves must be kept for intermittent requirements. In this way, and by this method, economical development of power should demand careful consideration, even where blast-furnace gases are not available.

There is, however, another means by which this energy cost can be further considerably reduced, *i.e.*, by the introduction of gas producers coupled with ammonia recovery and by-products plant.

From each ton of fuel gasified, sulphate of ammonia of a gross value equal to, or exceeding, the original cost of the coal is being, and has been for some years past, continually obtained. Fuel treated in a similar way, and with plant adapted to the purpose, is used for gas making, the gas of which is successfully utilised for the heating processes in a steel works, including the melting of steel in open-hearth furnaces. This gas has the by-products extracted from it, which yield a price higher than the original cost of the fuel. Such processes have been working for years, and, within my own personal knowledge, coal has been so gasified to the extent of about 1,000 tons per day.

While the Board of Trade returns show that the country's trade is in a flourishing condition, we have before us facts which demonstrate that :—

1. Of our blast furnaces, many are blown out.
2. Of our steel works, some are closed and others partially closed.
3. Of our iron works, many are running on short time.
4. Many of our skilled and unskilled workers are, of necessity, out of employment, and
5. On the whole, no adequate or reasonable profit, or remuneration, is being earned.

It is taken as a truism in this district that when the Clyde is busy (*i.e.*, when the shipyards are fully employed) trade generally, and especially the iron and steel trade, is also busy. What is the recent experience? During a recent quarter there was a record tonnage of shipping built and launched, while simultaneously the iron and steel works were turning out only a small part of their possible capacity, and that at what has been characterised as rascally unremunerative prices.

A ton of steel can be produced here, and is produced, from the raw materials to the finished article at a cost per ton as low as that in any other part of the world.

For this reason, then, our iron and steel industry has earned its right to exist, and so long as iron and steel are required in our own country, our country should supply such materials, without the necessity of artificial bolstering and inducements. Yet we have numbers of our iron and steel works closed down—wholly or in part—and numerous others working at an output much below their capacity, and hundreds of idle workers watching millions of pounds' worth of what they might be producing being brought into our own country.

Still, assuming that a ton of steel can be, and is, manufactured in this country as cheaply as in any other, one is struck with the low dividends paid by our manufacturing companies compared with those of other countries.

Amongst other explanations of the present state of our industry, I would suggest the following :—

1. The importation into our country of material, resulting in our own works being run at a less than full capacity, necessitating a struggle for existence on the part of the various manufacturers.

2. The fact that imported material is delivered here at less than cost price—in fact, at prices lower than ought to be paid if trade is to be a legitimate exchange of commodities.

It is an error to assume that the evils due to the importing of iron and steel are measured by the quantity so imported. The worst evil is the demoralising effect on our home prices. Where a limited number of buyers exists, along with an unlimited number of sellers, the havoc which can be played with legitimate and honest trade by one "blackleg" seller is incalculable, and, to my mind, is infinitely worse than the question of how much he sells.

To these causes I largely ascribe our relatively poor profits, and they explain, at least in part, the present aversion to entering on large capital outlay.

There are, at the same time, other agencies at work rendering the task of the manufacturer still more difficult.

Recent legislation has tended, and still tends, to the increased costs of labour and raw material.

The legislation of every manufacturing country but our own is actively interested in, and helpful to, its industrial progress, while it is the policy of our State, as such, to take no such practical interest, other than to maintain and endorse a policy of fierce internal, and one-sided external competition, and to discourage, or make impossible, combinations for the protection and preservation of any industry.

There is, however, one kind of trust or combination which our Government upholds (and possibly rightly so) viz., that which goes under the title of Trade Unions, which unions, amongst their other functions, act in restraint of labour at unremunerative prices.

Our iron and steel manufacturing industry will be decimated if it is to be subject to conditions which allow our competitors to under-sell, and so to break a fair selling price, by putting material on our market which, irrespective of cost, can be purchased at less than the price at which we are able reasonably to manufacture; not forgetting, as there appears to be a tendency to do, that a fair remuneration on invested capital is a necessary part of the cost. When and where capital ceases to be remunerative, it will also cease to be available, and industry will cease.

If, as is sometimes alleged, certain of our industries can only be maintained by the purchase and use of foreign material, at a price less than cost, then we truly are in a perilous condition.

To my mind, the British iron and steel industry is not maintaining its relative position, and has not obtained a fair share of the large increase in the world's demands.

I think I shall voice the feeling of everyone here in calling for an inquiry, failing which our iron and steel industry is, in my opinion, destined to a retrograde and dark future.

LEGAL.

The Hythe Telephone Dispute.

In the Chancery Division, on Friday, November 10th, Mr. Justice Swinfen Eady had before him the two motions arising out of the dispute between the National Telephone Co. and Hythe Corporation over the local telephone service (see Elec. Rev. pp. 732 and 773).

Mr. Micklem, K.C., who appeared on behalf of the Telephone Co. in the first motion, The Company *v.* The Hythe Corporation, moved to restrain the Hythe Corporation from revoking or otherwise determining the licences or the right now enjoyed by the plaintiffs to keep poles along the bank of the Royal Military Canal between the Town Bridge and Twiss Road Bridge, and to restrain them until the trial of the action or further order from removing or otherwise interfering with the poles. Although his clients had not taken this view throughout the whole of the negotiations, they were now insisting upon their strict rights, and were claiming that the licences were irrevocable; or, alternatively, if that were not so, then they could only be determined upon proper notice. Having regard to the length of time the poles had been there, and the difficulty of putting in new poles, the company claimed that a reasonable notice would at least give them until next year.

His Lordship: In fact, you only want a notice sufficiently long to tide you over till January 1st next.

Mr. Micklem: Exactly; but, instead, the Corporation proposes to give us until December 27th, and then insist on an immediate removal. The Corporation had apparently entered into an arrangement with the Postmaster-General, under which the latter had agreed that if the former would put an end to their arrangement with the company on December 27th, he would, in the interval between that date and the taking over of the company's system, put down the underground system which they desired. In view of this position, the Corporation had taken a most extraordinary line by insisting on the removal of the poles, and then, when the company undertook to comply with that request, they threatened immediate proceedings. Under an agreement with the company, the Postmaster-General had to take over and pay for the plant in actual use on the day of the transfer, viz., December 31st next. The result would be that if the company's poles in question at Hythe were removed before that day, they must lose the value of that portion of their system, which amounted to about £300.

In answer to his Lordship, Mr. Russell said that the Corporation had never threatened to remove the poles, but they would give no undertaking not to do so. He appeared for the plaintiff in the second motion of Dickens *v.* The Telephone Co., and his friend's motion was really being moved as a counterblast.

Mr. Micklem said that the real question was not between Mr. Dickens and the company, but between the Corporation and the company. The Corporation gave the company notice of removal of the poles within 14 days, and the company simply notified Mr. Dickens that they intended to do it.

Mr. Russell, in opening his motion, said that Mr. Dickens on February 26th, 1908, entered into a contract with the company to have their service laid on. He had paid the rent in advance up to March 10th, 1912, and having done so, he not

unnaturally expected to get what he had paid for if the company could give it. On September 22nd, however, the district manager of the company wrote to Mr. Dickens to the effect that, in consequence of a recent notice received from the Hythe Corporation requiring the company to remove certain poles connecting his (Mr. Dickens's) service with the main trunk system, that system would be discontinued. Accordingly, on October 20th, plaintiff's solicitors issued the writ. The company had got the use of the wayleaves until December 27th, and Mr. Dickens's point was that they threatened to cut him off at once, two months before it was necessary. That being so, the notice of motion on Mr. Dickens's behalf was that the company should be restrained from altering, disconnecting or otherwise interfering with any wire or line used for the telephonic communication of the plaintiff.

Mr. Micklem asked his Lordship to grant an injunction against the Corporation restraining them from moving the poles.

His Lordship, in giving judgment, said that it would be impossible to grant Mr. Dickens an injunction to restrain the company from disconnecting his telephone service, and compelling them to maintain his connection unless, at the same time, the company were enabled to do so by maintaining their poles and wires. He then proceeded to outline the facts in regard to the motion of the company against the Corporation, and declared that the change in position which the Corporation from time to time took up was almost Gilbertian in humour. He had read the correspondence, and it appeared that at one time the Corporation would say the telephone poles must be removed at once. The company would agree to do so, and after a little "conversation" between the parties, the Corporation would postpone the operation of the order. Later, however, another notice would be sent to the company to remove the poles at once. Again the company replied they would do so, and gave instructions to their workmen. Thereupon the Hythe Corporation would turn round with remarkable agility, and threaten the company with an injunction if the poles were removed. It was asked what was behind it all? Well, it would seem that the Hythe Corporation desired to insist on the wires and poles remaining until December 27th, and then they must be at once quickly removed and cleared away before December 31st. But what, might be asked, was the object of doing this? It appeared that if they remained up until December 31st the Postmaster-General would take them over and the Government would have to pay the company for them, whereas if they could only procure their removal before that date, the Government would not have to pay for them. Then it might be asked, but what concern was that of the Corporation of Hythe? It appeared, however, that under an arrangement which had been described as exceedingly satisfactory, the Corporation had arranged with certain officials of the G.P.O. for an underground service to be installed forthwith to take the place of the Telephone Co.'s service if the latter's service were removed, if not by December 27th, at least by the 31st. It had been suggested that the matter might be allowed to drift on till December 27th, and then see what could be done, but he thought it would be melancholy if the Court were to adopt such a course, as the result would possibly be a free fight on the land in question when the day arrived. The Corporation, with a squad of men, might invade the land and take possession of the poles until a superior squad of men belonging to the company drove out the invading army. The justice of the case required that the defendant Corporation should be restrained from removing or otherwise interfering with any of the poles or wires of the company until judgment or further order; that the Telephone Co. remain in possession of the poles, and that Mr. Dickens should also have an injunction restraining the Telephone Co. from severing his connection.

His Lordship further ordered the costs in each case to be the costs in the action.

Workmen's Compensation Claim against the Charing Cross Electricity Supply Co., Ltd.

At the Bow County Court, on Monday, Judge Smyly, K.C., heard an application under the Workmen's Compensation Act made by George Charles Avent, a switchman, against the above company, of St. Martin's Lane, Charing Cross.

Mr. Clements, for the applicant, said that he had been in the employ of respondents since 1905 as a switchman, and it was part of his duty, on certain occasions, to clean the switches at the station in Marshgate Lane, Stratford. About 7 a.m. on April 13th last he was engaged in cleaning certain of the switches, when he received an electric shock of nearly 10,000 volts, which rendered him unconscious. He was removed to the hospital, suffering from injuries to his left arm and burns on his face and body. In the end his left arm had to be amputated. His wages were 36s. 2d. a week, and from the date of the accident until July 8th he was paid £1 a week as compensation. He admitted that, by Rule 8, they were forbidden to enter an extra-high-tension chamber, but he was engaged at the time of the accident on a gallery and not in a chamber. It was an interconnecting switch which caused the accident.

Applicant was closely cross-examined by Mr. Shakespeare, who appeared for the respondents, as to the technical part of his evidence and as to the nature of the switches with which he had to deal. He stated that they could only be reached by climbing over the steel bars or crawling under the switches.

Edwin O'Shea, a fellow workman with the applicant, said there was no guard to the interlocking switch, and a man cleaning it would be unprotected when it was alive. There was a guard there now, he believed.

Mr. Shakespeare objected that this was not evidence.

His Honour: I do not see how it is not.

Mr. Shakespeare: It has been held in the High Court that you cannot show that a man has been wise after the event.

His Honour: But they have not excluded the evidence.

Witness, continuing, said that after climbing over the bars applicant would be near the interconnecting switch, and was found about 4 ft. from it.

Mr. Shakespeare: What is there requiring you to get on top of the switch?—Witness: There are insulators which must be cleaned and contacts which the insulators surround.

The highest is 3 ft. 10 in. from the ground; do you ask his Honour to believe that you have to reach up to this?—Yes, to get at the other side.

Will you pledge your oath that either Mr. Yates or Mr. Golbourn, the engineers, have seen you on top of the switch?—I will.

Continuing, Witness said he had never been in the testing room unless both systems were dead. It appeared to him dangerous to do so. He did not know it was against the rules to go into the testing chamber at all.

Thomas Roberts, another switchman, said there were no high-tension chambers on the gallery in which the applicant was engaged. From one switch to another they had to squeeze past a buttress, but to reach the motor-generator switch he had not climbed the bars. There was a door, but he had never been through it. Cross-examined: The second gallery was not a switchboard, but a place where the switches were.

His Honour allowed the switchmen to leave as soon as they had given their evidence, remarking that it was not desirable that half the city should be plunged into darkness during their absence.

For the respondents Mr. Walter H. Kingston, the manager of the station, said it would be absolutely contrary to their regulations for anyone to pass through a certain door through the testing chamber, and past the interlocking switch, when the latter was half alive. There was ample room for men to pass without doing this. There was no reason to climb on the top of the generator switch to clean it.

Mr. Yates, a switchman, gave evidence as to the rules forbidding any man to go past the generating switch when it was half alive.

Mr. Shakespeare, for the respondents, said the applicant to succeed, must show that this was an accident arising out of and in the course of his employment, and that the risk was one which was contemplated by the employer at the time when the contract was entered into with the workman. When they looked at the evidence given there, it could not be said that the accident was one arising out of his employment, for applicant had sworn that he had been forbidden to clean any of the switches when they were alive. The contract of employment did not include switches when they were alive. He was doing something which he was never employed to do, and which, in fact, he was strictly forbidden to do.

After further argument judgment was reserved.

British Westinghouse Co., Ltd., *v.* The Underground Electric Railways Co. of London, Ltd.

At the conclusion of the arguments on the appeal in this arbitration, their Lordships reserved judgment.

Interesting Tramcar Case.

At Woolwich Court, before Mr. Hutton, according to the *Standard* report, an interesting point was raised when Harold Vincent Dimon was summoned for driving a tramcar on the Woolwich-Eltham system without two overhead conductors being in use. Mr. Barker, for the police, said an accident occurred, and Dimon was tried at the Sessions on a charge of causing bodily harm, but was acquitted. Mr. Jenkin, defending, argued that the Council, and not Dimon, were responsible, because the Regulation read, "any person using electrical power," and the Council answered to the "person" in this case. The Magistrate ruled against this view, but himself questioned whether the man at fault might not be the conductor, whose business it was to put up the second trolley pole. Mr. Barker submitted that the driver was in charge of the tramcar, and the conductor could not put up the pole unless the driver stopped the car. Mr. Hutton fined Dimon 5s., saying that he did so on the ground that the defendant drove the car without the second trolley pole or conductor being in use.

City of Birmingham Tramways Co., Ltd.

Mr. Justice Parker, in the Chancery Division, had before him on Tuesday a petition by the City of Birmingham Tramways Co., Ltd., seeking the sanction of the Court to a proposed scheme of arrangement with its debenture-holders, which would have the effect of releasing certain specifically charged assets.

Mr. H. E. Wright, in support of the petition, said that it was brought under the Companies' Consolidated Act of 1908, and the scheme was a very simple one. The company was a very prosperous one, and the debentures in question were all debentures to bearer. The company had sold most of its tramways, and it was contemplated that there would be almost immediately a further sale of the rest to the Birmingham Corporation for £150,000.

When that sale had been carried out the company would have no tramways left at all, but under the terms of the debentures, the debenture stock could not be paid off until 1917, and the company was, therefore, bound to keep matters as they were until that date. The company was incorporated in 1906 for the purpose of carrying on these tramways, and it had a capital of £1,000,000 divided into 200,000 shares of £5 each. The company had borrowed £300,000 on debentures to bearer, and although the whole £300,000 were issued, £97,500 worth had been redeemed and transferred into the names of trustees as part security for the sinking fund. Part of the proposed scheme was to cancel these debentures altogether, instead of keeping them in a state of suspended animation. There was a very large margin of security, and it was proposed to release a proportion of the specifically-charged assets.

Mr. Justice Parker asked what the debenture-holders were to receive in consideration for the release of their rights. It seemed to him, he said, a one-sided arrangement. What did the company propose to do when they got the scheme through?

Mr. Wright said that the company desired to invest the assets over a wider field. As a matter of fact, they belonged to the British Electric Traction group, which intended to carry on a large tramway trust in the Midlands. If the scheme went through the debentures would still be secured over and over again, and the company would undertake always to keep the securities up to 10 per cent. over and above the amount of the debentures. They would, in fact, be quite willing to make it 20 per cent., and would undertake not to issue any debentures in priority to or ranking *pari passu* with those now outstanding.

His Lordship said that there were now assets to the amount of £400,000 to secure debentures to the value of £200,000, and at the meetings at which these proposals were suggested only £1,800 worth of debentures was represented. It was therefore as if he was being asked by a very small minority to sanction a scheme which was not in favour with the debenture-holders. He could not approve of a scheme which did not commend itself to him from a business point of view. In his opinion, the debenture-holders should receive some compensation by way of increased dividend, or something of that sort, in consideration of what they were giving up. He would not dismiss the petition, but would direct it to stand over for further consideration.

Mr. Wright said he would communicate his Lordship's views to his clients.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Radiator Lamp Substitutes.

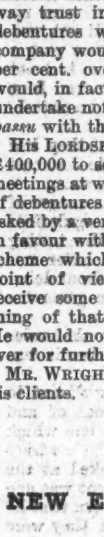


Fig. 1.—"Economic" Radiator Lamp Substitute.

A device to replace the ordinary radiator lamps was first introduced by Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., in September of last year, but was made for voltages not exceeding 120 volts, it being necessary to run the substitutes in series above this voltage. We have now received particulars of substitutes to run singly on voltages up to 250 volts, D.C. and A.C. A single substitute can be made to consume 500 watts, making it possible to convert a two-lamp into an equivalent four-lamp radiator, thus saving the extra first cost of the larger radiator.

These substitutes are practically unbreakable, run at bright red heat, have a long life, and a new element can be inserted in a few minutes at a low cost, thus avoiding the purchase of a new radiator lamp, which is of course useless when burnt out. The slight additional cost of the substitutes over that of the radiator lamps is quickly saved. The appearance of the device, which is composed almost entirely of metal, is shown in fig. 1.

New Type of Police Lamp.

The adoption of the electric lamp for police work is of special interest to electrical engineers, and in this connection the Thomson lamp, introduced by Messrs. L. E. Wilson and Co., of 20, Cross Street, Manchester, appears to meet with considerable success. Police authorities do not all agree as to the type of electric lamp which would be suitable for their work; the size, the weight, the dimensions of reflector, and duration of light, all have been questioned in turn, and, in consequence, the variation in the requirements tends to make the work of standardisation a difficult proposition. The question is essentially one for the technical man, and therefore the tendency in the past to leave the police authorities to conduct their own tests is, in a measure, responsible for most of the variation of opinion encountered.

The Thomson accumulator in its present form is the result of these years of experience; the operation of re-charging is simple in character, and, beyond adding distilled water to the accumulator for the purpose of keeping it moist, little further work is involved.

The question of accumulator capacity is important from a police point of view, as the lamp should be capable of giving light for at least two normal duties, with sufficient reserve for contingencies. The light given by a glow lamp consuming 3 ampere is far superior to that of the oil lamp, and from data collected, the average duration of light required for inspecting property is fairly well known; the light is not maintained permanently, but the flashing arrangement is used, and the constable is not rendered more conspicuous than necessary, which is another facility not afforded by the oil lamp; there being no smell, a still further advantage can be claimed, for the wrongdoer's sense of smell is almost as keen as his eyesight. The question whether a concentrated or diffused light is required by the police is also one which requires consideration.

In the Thomson Police Lamp the accumulator is firmly fixed in the case by spring clips, and access to all working parts is made easy by the adoption of a hinged door secured by a spring clip. The specially designed switch contains several important and interesting features, and is arranged for flashing or fixing the light as required. The glow lamp can readily be removed, and as there are only a few contacts in the lamp, there is very little apparatus to get out of order. Some lamps are equipped with wire handles, in addition to the strong belt attachment, and these are more especially required in places where an examination of stairways is an important part of the policeman's duty.

In some quarters belts are not worn by the police, and an electric lamp, known as the Military Lamp, is carried in a special pocket provided for the purpose.

Twin Lampholder.

Messrs. Galsworthy, Ltd., of 15, Newman Street, W., have introduced a patent twin lampholder (fig. 2) of compact design,

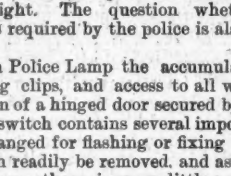


Fig. 2.—Twin Lampholder.

which is claimed to be the only twin holder on the market which can be wired either singly, series or in parallel.

The usual T-piece being omitted, some 2 in. is saved in length.

The holder is made in four sizes, in large and small Edison screw and bayonet-socket types, also as a single or end holder, and is useful for window, picture, sign and concealed lighting generally.

BUSINESS NOTES.

Pump Contracts.—The following are some contracts recently received by Messrs. Ernest Scott & Mountain, Ltd., for large centrifugal pumps:—

One pump to deliver 1,000 gallons per minute against 600 ft. head at 1,300 R.P.M. driven by a D.C. motor of 300 H.P. capacity, for Park Colliery Co., Ltd.

One pump to deliver 700 gallons per minute against 600 ft. head at 1,300 R.P.M. driven by a D.C. motor of 210 H.P., for Messrs. Edinburgh Collieries, Ltd., to the instructions of Messrs. D. Selby Bigge & Co.

One vertical centrifugal pump to deliver 1,500 gallons per minute against 135 ft. head at 1,000 R.P.M. driven by a D.C. motor of 95 B.H.P., for Colness Iron Co.

One pump to deliver 250 gallons per minute against 500 ft. head at 1,440 R.P.M. driven by three-phase motor of 55 B.H.P., for Consett Iron Co.

One pump to deliver 125 gallons per minute against 440 ft. head at 2,880 R.P.M. driven by a three-phase motor of 30 B.H.P., for Consett Iron Co.

One pump to deliver 750 gallons per minute against 62 ft. head at 1,400 R.P.M. driven by a D.C. motor of 24 H.P., for Blyth Shipbuilding Co., Ltd.

The Indian Import Trade.—A review of the trade of East India in 1910-11 has recently been issued as a Blue Book. It shows that the imports of machinery experienced a decline of £220,000 as compared with the preceding year, this being the second year in succession for a reduction in the arrivals of machinery to take place. The share of Bengal was, however, £53,000 larger than in 1909-10, and the increase included £40,000 in electrical machinery, largely for the Tata Ironworks. In the imports of steam engines there was an improvement, the value being £546,000, but this total does not reach the level of two years ago. The imports of electrical and mining machinery, which amounted to £263,900 and £92,200 respectively, were the best on record. On the other hand, the Indian purchases of railway material decreased by £1,469,000, as contrasted with 1909-10, and in this case also the total of £4,124,000 for 1910-11 was likewise very considerably less than the total of £7,960 000 in 1908-9. The value of the imports of electrical and scientific instruments and apparatus in the past two years is returned as follows:—

	1909-10.	1910-11.
Electrical instruments and apparatus ...	£289,812	£343,382
Scientific instruments and apparatus ...	180,019	209,067

It will be seen that the electrical apparatus increased by 18·5 per cent. in 1910-11, and scientific apparatus by 16·1 per cent. The total quantity of machinery and mill work was valued at £3,154,000 in 1910-11, as against £3,374,000 and £4,411,000 in the two preceding years respectively.

Correction.—In our last issue, in "Official Returns," an error occurred in one of the titles. For Anglo-*American* Electric Co., Ltd., read Anglo-Mexican Electric Co., Ltd.

Patent Applications and Restorations.—Application has been made by Frank Michael Lewis for the restoration of a patent which expired in February, 1911, owing to the non-payment of renewal fee—namely, "Improvements in or connected with electric arc lamps," No. 4,557 of 1903.

The Comptroller-General has issued orders restoring the following patents :—

No. 7,320, of 1907. "Improvements in arc furnaces for the electrical treatment of gases." Granted to Salpetersaure Industrie-Gesellschaft G.m.b.H.

No. 849, of 1904. "Horizontal double-action lever pump." Granted to Frederick Thould

Catalogues and Lists.—The Underfeed Stoker Co., Ltd., Coventry House, South Place, London, E.C.—80-page catalogue containing full information regarding the "Underfeed" stoker, its theory and principle, with descriptions of different types of the stokers, their applications and the manner of their operation. Reports of tests showing economies, boiler efficiencies and smokelessness with underfeed stoking shown graphically in comparison with those with other systems of firing, and a great deal of other information of interest to boiler house and power station engineers, are given, together with points for coal-users on calorimetry, coal classification and analysis, the heating value of coals and their determination. Large and well executed half-tone photographic views showing the underfeed stoker, its parts, and many boiler houses where it is in service, run right through the book. The company have, as the above has indicated, endeavoured to introduce much matter making the catalogue of service to all engineers and others interested in the all-important question of efficient stoking.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot.—12-page illustrated pamphlet containing information accompanied by a number of diagrams, &c., regarding telegraph apparatus manufactured by them—the B.I. fast speed pole changer and new method of closed-circuit working.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, London, S.W.—New telephone apparatus catalogue, No. 535, of about 70 pages, containing many well-executed and well-arranged illustrations (art paper), with descriptions and prices of those articles among Messrs. Siemens's more numerous telephone apparatus manufactures which are in fairly general use. The contents include the following classes :—Competitive battery telephones, intercommunication sets, magneto telephones, C.B. instruments, portable, loud-speaking, high-tension and watertight instruments, switchboards, arresters, condensers, &c., and a telegraphic code and index. Attention may be directed to intercommunication sets with metallic circuits, metal-cased C.B. instruments, theatre-pattern loud-speaking telephones and mining telephones. Copies of the catalogue can be obtained by writing to the firm at Woolwich. Messrs. Siemens have also issued a leaflet supplementary to their "Stannos" catalogue, describing the "Twiston" connector for tapping "Stannos" sheathing, when used for concentric wiring, without the necessity for soldering ; also biscuit blocks prepared in various finishes.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Eight pages of their new catalogue, giving tabulated prices of knife switches and change-over switches, also illustrations, brief particulars and prices of fuseboards, "Soleed" porcelain handle replacement fuses, multiple-way switches, auto cut-outs for accumulators, shunt regulators, motor-starters and ship-lighting boards. Copies can be had on application.

Allgemeine Electricitats Gesellschaft, Berlin.—Pamphlets relating to automobile tower wagons, propelled by petrol and by electricity ; new overhead line material for tramways ; new tramway motors with commutating poles ; and an electrostatic indicator of the presence of high-pressure electricity on conductors, from 3,000 to 75,000 volts.

Messrs. W. Sisson & Co., Ltd., Gloucester.—30-page booklet giving neat half-tone illustrations of, and testimonials and reports concerning, the Sisson patent enclosed engine for electrical work, steam consumption curves being included.

The Reason Manufacturing Co., Ltd., Brighton.—Half-a-dozen introductory or advertisement leaflets, illustrating a few of their manufactures, including "Q.M.B." D.P. ironclad switches, "Bayley" hand lamps, electric clocks, outside lighting fittings (the "Bright'un"), electrolytic meters, &c.

Messrs. James Neil & Sons, Ltd., Grange Ironworks, Shettleston, Glasgow.—Pamphlet containing effective views in colour of their new incandescent rocking-bar furnace and patent double rocking firebars. A separate booklet contains a number of logical arguments on forced draught.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflet No. 119, relating to the uses of aluminium in the service of electric traction showing side panels for railway coaches, interior panelling, trolley heads and aluminium field coils.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—Twelve-page catalogue (Section W), tabulating sizes and prices of vulcanised wire and cables, twin lead-covered wires and cables, fuse wires, flexible cords, and electric bell wires, also illustrating and pricing a number of jointing accessories, including porcelain connectors and insulators.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.—Two new catalogues (28 pages each) one containing a very full and illustrated account of the "Ducter" patent potential ohmmeter, its method, constructional details, and uses, with a table of temperature factors for copper, and particulars of prices ; the other dealing equally exhaustively, and with many explanatory diagrams and views, with Evershed's testing sets for insulation and conductor resistance. We are asked to state that all previous catalogues for these specialities are now withdrawn, and copies of the above new lists can be obtained on application.

The Rees Roturbo Manufacturing Co., Ltd., Wolverhampton.—Collection of pamphlets, prepared in excellent style, with finely printed half-tone pictures on art paper. The whole are brought together in an expanding binding cover, and they contain the following information :—Specification of the Rees "Roturbo" self-regulating centrifugal pumps for mining and colliery service, with notes and diagrams explaining the principles and construction, table of duties, dimensions, weights, &c. ; description of the pump at Crumlin Navigation Colliery ; Rees "Roturbo" electrically-driven boiler feed pumps, containing specification and tabulated data ; pumps for fire service ; oil-engine-driven pumps ; and reprints of a number of articles appearing in the engineering Press on the pumps used for electric sewage and storm-water service, sea-water supply, &c.

Wiring Contracts.—Messrs. J. E. Cuthbertson and Co., of Falkirk, have received the following contracts :—

Lighting and power installation at Larbert Parish Church.
Addition to Larbert Co-operative Society premises.
Electric light installation at Stirling County Council new offices.

Theft of Telegraph Wire.—Before the Recorder last week, three young men were charged with stealing copper telegraph wire, the property of the Postmaster-General, from poles along the Regent's Canal. It was mentioned that the cutting of wires had been going on for years, and had cost the Post Office a great deal during the past 12 months. William Chown was sentenced to 12 months' hard labour, and Thomas Green to six months' imprisonment.

Reliable Rectifiers.—In reply to a letter in our "Correspondence" columns on this subject in our last issue, several firms claim to be able to supply rectifiers which can be depended upon—notably Messrs. Isenthal & Co. and Messrs. Muirhead and Co., Ltd. The Aluminium Rectifiers Co. and the Westinghouse-Cooper Hewitt Co., Ltd., also write to the same effect.

Trade Announcements. — Mr. W. R. Squire has opened an office at 288, Broad Street, Birmingham, where he is making a speciality of private telephone work for all purposes.

Messrs. Ship Carbons, Ltd., 67, Aldersgate Street, London, E.C., have been appointed sole agents in the United Kingdom for the "Watt" electric lamp works, of Vienna, Austria, makers of the "Monowatt" metallic-filament lamps and carbon lamps. They will carry stocks in London. We have received a leaflet stating prices.

Messrs. W. A. Laws & Co., of 7, Exchange Buildings, Whitley Bay, have taken over the electrical business (contracts and stock) of Messrs. Gray & Gray, of Newcastle-on-Tyne, and Mr. Wood, late electrical engineer to the firm, has joined Messrs. Laws. Mr. A. Gray has accepted a lucrative appointment in Rhodesia, and the firm of Gray & Gray is discontinued.

The business of the late Mr. G. W. Hull, electrical engineer, of Pangbourne, has been taken over by the Felgate Installation Co., Ltd.

Mr. W. J. Coles, M.I.E.E., of Messrs. Maxted, Knott & Coles, consulting engineers, Hull, has been appointed engineer-in-charge of the cement and crushing machinery department of Messrs. Edgar Allen & Co., Ltd., of Sheffield, who prepare designs, &c., for complete equipments of such plant, including the necessary power plant. Mr. Coles announces that his consulting practice will be continued, and he will advise on electrical and other matters as hitherto. His address, until December 1st, is 231-232, Birkbeck Bank Chambers, W.C., and after that care of Messrs. Edgar Allen's London office, 52, Queen Victoria Street, E.C.

Osram Lamp Patents.—As will be observed from announcements appearing in our advertisement pages this week, the Edison and Swan United Electric Light Co., Ltd., have recognised the validity of letters patent No. 23,899 of 1904, and other letters patent owned by the Osram Lamp Works, Ltd., for the manufacture of Osram lamps. The Edison and Swan Co. have taken up a licence from the Osram Co. to use the above patents for the manufacture of their own metal-filament lamps, and they notify the trade and the public that on that account they run no liability or risk of patent litigation by purchasing Royal Ediswan lamps which they manufacture at their Ponders End and Newcastle-on-Tyne factories.

Lamp-Selling Campaigns.—Messrs. Siemens Bros. Dynamo Works Co., Ltd., of Tyssen Street, Dalston, are always very much alive, but as is usual at this period of the year, they are in the throes of a veritable trans-Atlantic hustle, with an advertising campaign pushing their lamps and other lighting material for the current lighting season. With their "Tantalum" showcard competition, and the result of it, our readers are already well acquainted, and at the present moment the provinces are being "taken by storm," practically every town of importance being enlivened, enlightened and beautified by these posters. "Little Bill" showcards in several colours have been circulated in thousands among trade customers, together with literature bearing the contractor's own name. Contractors who like to ask for them can have quantities of facsimile reproductions of the poster on postcards. Beyond the foregoing, there is a provincial newspaper campaign in progress, and electricity users are being circularised, to, we under-

stand, the tune of hundreds of thousands, hammering into their wooden heads that the tantalum is the lamp for them. Underground and other railways, carriers' vans and other media have likewise been selected for making the same appeal. A campaign which has been adopted on such a scale, and with the intention of co-operating with the trade generally, cannot fail to bring success to its originators, while it must assist in the general popularisation of electricity.

Book Notices.—*The Ten Republics.* By Robt. P. Porter. London: George Routledge & Sons, Ltd. Paper covers, 1s. net.—This is the first of a series of volumes on the Ten Republics of South America. The object of the series is to enlighten the British public concerning South American affairs and promote closer commercial and other relations between Great Britain and the 10 nations. The present is an introductory volume preparing the way for 10 others that are to follow dealing with the industrial and economic progress of each Republic separately. Mr. Porter, as most people know, has visited many of the Latin Republics, has had audiences granted by 20 South American Presidents, and has had placed at his disposal the bulletins and reports of the Pan-American Union; he is, therefore, in a position to write with authority on the progress that they are making and their importance as fields for British enterprise. In view of the articles which have appeared in our pages from time to time, it is unnecessary for us to indicate again here how large a share of the foreign capital invested in, and the foreign trade done by, the Republics, is British. In the first chapter the author deals with early history, very briefly outlining the course of events down to date, and the politics appertaining to the Republics; the economic and industrial progress of the latter are next reviewed, and there follow chapters containing much valuable information regarding each of the following:—Panamá, the Argentine Republic, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela. Twelve useful maps add considerably to the value of this introductory volume. We have no doubt whatever about the usefulness of Mr. Porter's books to those who desire to become better acquainted with South American trade and finance; probably when our readers have read the first of the series they will be anxious to secure the others.

"Bearings and their Lubrication." By L. P. Alford. Price 10s. 6d. net. "The Magnetic Circuit." By V. Karapetoff. Price 8s. 6d. net. "Electric Railway Engineering." By C. Francis Harding. Price 12s. 6d. net. 1911. London: Hill Publishing Co., Ltd.

"The Elements of Electrical Transmission." By Olin J. Ferguson. 1911. London: Macmillan & Co. Price 15s. net.

We have received from the Town Clerk of Falmouth a copy of an authorised and official illustrated booklet, giving particulars of the town, its climate and resources. The air renders the place particularly suitable for winter residence. Anyone interested can obtain a copy of the brochure by sending a card to the Town Clerk at the Municipal Offices.

The "Mechanical World" Pocket Diary and Year Book for 1912. Manchester: Emmott & Co., Ltd. Price 6d. net.—This well-known annual is the first of its kind to reach us this autumn; it contains various new sections, and several of the older ones have been revised or rewritten. It is wonderfully good value.

"The Technical Journal." Vol. IV, No. 4. October, 1911. Liverpool: The Northern Publishing Co. Price 1s.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. II, part 8. September, 1911. Johannesburg: The Institute. Price 2s.

"Die Selbstanschluss und Wählereinrichtungen im Fernsprechbetriebe." By A. Kruckow. 1911. Brunswick: Vieweg & Sohn. Price 10 M.

"*Engineering* Directory." October, 1911. London: *Engineering*, Ltd. Gratis.

"The Motor Manual." 1912. London: Temple Press, Ltd. Price 1s. 6d. net.

New Zealand.—The Customs authorities of New Zealand have recently given a decision to the effect that "electrical appliances, viz., brushes, carbon, wire gauze" are to be classified under No. 169 of the Tariff, the duty being at the rate of 15 per cent. *ad valorem* on foreign goods, and 10 per cent. on British manufactures.

Liquidation.—Howe Electrical Engineering Co., Ltd.—A meeting is called for December 14th at 7, Victoria Street, Liverpool, to hear an account of the winding-up from the liquidator, Mr. Arthur Thraves.

Bankruptcy Proceedings.—Wm. Henry Howard, electrical engineer, 17, Russell Road, Finsbury Park, and lately carrying on business at 5, Featherstone Buildings, Holborn, E.C., as the Holborn Electrical Co.—Under a receiving order made in the London Bankruptcy Court the first meeting of creditors was held on Monday before Mr. G. W. Chapman, Official Receiver. Having called over the proofs of debt, the chairman stated that the debtor appeared to have commenced business in 1900, by becoming a partner with Mrs. Emma Lea, who was then trading at 60, Red Lion Lane, E.C. No deed of partnership was prepared; the debtor had no capital, but he brought in his experience, and they traded as the Holborn Electrical Co. about three years, the profits being equally divided. On the dissolution Mrs. Lea retired from the firm, and the debtor continued the business alone. In 1907 he removed to 49, Lamb's Conduit Street, W.C., where he traded in the former style, and also as Howard & Co. Six months later he removed to more commodious premises at 1, New Oxford Street, and there traded for six months. The landlord, without his consent, entered upon the premises in order to repair the roof, and thereby damaged his business and stock. The debtor then removed to 5, Featherstone Buildings; two years afterwards he removed to 64, Red Lion Street; but finding the rent too heavy, he returned to Featherstone Buildings, and there traded until last April. Three years ago he commenced proceedings against the landlord of the New Oxford Street premises for trespass in connection with the above-mentioned repairs to the roof. Judgment, however, with costs, was given against him, to which fact, combined with want of capital, and general falling-away of business during the last three years owing to competition by electrical supply authorities, he attributed his insolvency. During the legal proceedings he was unable properly to devote his attention to the business, which fell off considerably; owing to lack of capital, he was unable to recover lost ground, and finding the position hopeless, he closed the business last April. He had since been pressed for the landlord's costs in the action, and eventually in order to avoid committal proceedings, he filed his petition on November 1st. He is now in employment. The statement of affairs showed liabilities £506, and assets, "doubtful and bad debts, £78." In the absence of any proposal, the case was left in the hands of the Official Receiver to be wound up in bankruptcy, the public examination of the debtor being fixed for December 21st. Appended is a list of the principal unsecured creditors, viz.:—

Buddscom, R. A.	£65	Griffiths & Son	£75
Bodien, Mrs.	19	Jackson & Co.	23
Cutting Bros.	17	Leverson, L.	43
		International Time Recorder Co.	£24.

William Francis Flint, electrical engineer, 53, Jameson Street, Kingston-upon-Hull.—The public examination of the above debtor took place on Monday, November 13th, at the Court House, Town Hall, Hull, before Mr. Registrar Farrell. The statement of affairs showed liabilities £1,743, and the debtor said that of this £792 was due to his father. He was indebted to the bank to the extent of £424, and the bank held a guarantee from his father up to £100. The assets were estimated to produce £637. Debtor said he had lost £400 on contracts. He obtained the contract for the lighting of the King's Hall, Hull, his being the lowest tender, and he expected to make a profit of £40. The amount of the contract was £530, and he was paid £400, and he had returned the contractees as being debtors for £126. The debtor admitted, however, that the work was gone over after he had considered he was finished with the contract. The Official Receiver: And so many imperfections were found that it practically had to be done over again?—Debtor: Yes. Continuing, he said he had made a loss of £350 through that contract, while bad debts were responsible for a loss of £138. He added that competition had been very keen, and it had been difficult to obtain a contract on which a profit could be made. He considered that his business had been a failure from the start. The examination was concluded.

W. R. Newbold Gard, electrician, West Ealing (lately at Orchard Electrical Works, Canterbury).—Receiving order made at Brentford on November 8th, on debtor's application.

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co., Ltd., has quoted £400 per annum as the price it would charge for the supply of electricity for pumping purposes at the sewage works, and ¾d. per unit for all units consumed. The quotation, it was explained, was made on the understanding that the supply would not be used, except in an emergency, during the hours of the maximum demand, and that the steam plant, if used at all, was only to be used on those occasions. The offer was rejected, it being arranged that the matter should be subjected to further consideration.

Ashburton.—The U.D.C. has decided not to accept the terms of Messrs. Purves, of Exeter, for an electric light installation for the town, viz., that the Council should guarantee a sum of £350 towards the cost, and a yearly sum of £30.

Bretby.—The Burton-on-Trent T.C. has applied to the Repton R.D.C. for consent to extend the E.L. supply to Bretby by means of a low-tension overhead line. The matter is being considered by a Committee

Briton Ferry.—The U.D.C. has applied to the B. of T. for permission to use overhead wires for the transmission of alternating current at a pressure of 230 volts, for the supply of electricity to private houses in the town.

Continental Notes.—Germany.—It is proposed to form a company for the purpose of electricity supply throughout the Palatinate. According to the scheme prepared by Mr. Miller, of Munich, in conjunction with the Rhenish Schuckert Co., the project is to be carried out in three stages, the first representing connections of 25,000 KW., the second 41,000 KW., and the third 80,000 KW. The supply would be obtained in the first place by the establishment of a new power station in Homburg, and, secondly, from the existing stations in Ludwigshaven, Pirmasen and Kaiserslautern, although these three would only be used at the time of heavy load, so that the cost of production could be kept as low as possible. The total capacity of the four works in the three stages would be 15,000 KW., 19,000 KW. and 36,000 KW. respectively. The Homburg station would be situated near coal mines and where

there is plenty of water, and thus be certain of economical working. It is proposed to step up the current to a pressure of 100,000 volts for transmission throughout the Palatinate, and to reduce it to from 100 to 400 volts for supply to consumers. The total expenditure on the works would be £1,200,000, of which a small portion would be provided by the local authorities and the contractors, whilst the remainder would be raised by the issue of debentures or by a loan guaranteed by the local authorities. The company would have the right to use State roads or property for the installation of cables for a period of 75 years, although the State would be authorised to purchase the undertaking after the lapse of 40 years. It is suggested that the works should be leased for a term of 17 years, so as to secure the guarantee of the payment of interest on the capital provided by the local authorities.

Spain.—The severity of competition in the supply of electricity in the Spanish capital is stated to have had an unfortunate effect upon the Madrid General Electricity Co., the situation of which has been examined by a Committee appointed by the French National Association of Foreign Bondholders. According to the report prepared by the Committee, the company was formed in 1889, and has at present a share capital of 6,000,000 pesetas and a loan debt of 10,730,000 pesetas and 8,940,000 pesetas; a large portion of the loan having been raised in France. During the first 10 years the company distributed dividends up to 26 per cent., but keen competition in the supply business has taken place since 1899. In 1897 the company purchased a large portion of the shares in the Electricity Supply Co. for Spain, Ltd., and in 1900 the northern central station built by the Schuckert group was acquired, whilst the working of the Electricity Supply Co.'s station was taken over in 1901, on the payment of a rental graduated according to the gross receipts. The payment of dividends ceased in 1903, but was resumed in 1907, 1908 and 1909. Since the last-mentioned year competition in Madrid has become very keen. As a consequence of the opening of a hydro-electric works belonging to the Electra Co., the price of electricity was reduced in August, 1910, from 1 peseta to 60 centimos per KW.-hour, and it has now been lowered by the Electra Co. to 40 centimos. Various efforts have been made to bring about an understanding, but without any practical result. The Madrid company in the circumstances finds itself compelled to provisionally postpone the payment of the January coupons. The company's accounts for 1910 showed net profits of only 933 pesetas, which sum was carried forward.

France.—To cover the expected deficit in the Budget of 170,000,000 fr., the French Finance Minister proposes to tax what is termed lighting *de luxe*. Coal and acetylene gas and electric lighting are alike affected. The threatened taxes on the last-named are to be, firstly, 0·005 fr. per KW.-hour, but public lighting supply and current used for heating furnaces and other industrial purposes, and for driving vehicles, are to be exempt; secondly, electric lamps, carbons, &c., are to pay on the following scale:—Up to 10 watts inclusive, 5 centimes for carbon and 10 for metal-filament; 11 to 60 watts, 5 and 15 centimes; 61 to 100 watts, 10 and 30; 101 to 200 watts, 15 and 50; 201 to 300 watts, 25 and 70; and 301 to 400 watts, 55 and 90. Mercury vapour lamps and neon tubes are to pay a uniform sum of 3 fr. per metre length; arc lamp carbons are to be taxed at 20 centimes per kg. The French Technical Press is much disturbed at these proposed taxes, which it regards as the prelude of possible futher exactions. The examples of Spain, Italy and Germany are cited in support of the tax, but it is retorted they are not fair parallels, as their general taxation is not so heavy as in France. For the Government it is claimed that the taxes will only level up to those already imposed on other illuminants—candles and petroleum.—*La Lumière Electrique.*

Crewe.—The Corporation is borrowing £3,600 for the purpose of extending the electricity undertaking.

Cuba.—Senor Antonio Ramos Valderas has obtained concessions for the establishment in Santo Domingo and in Esperanza, both in the Province of Santa Clara, of central electric generating stations for electric lighting purposes. These concessions are subject to the approval of the municipal councils in the above-mentioned towns.—*Board of Trade Journal.*

Dolgelly.—The U.D.C. has decided to carry out an E.L. scheme at an estimated cost of £3,000.

Doncaster.—Owing to the decision of the L.G.B. in declining to sanction the whole of the loan recently applied for, the T.C. has decided to meet a sum of £2,445 expended in recent improvements and extensions in connection with the electricity undertaking, out of revenue.

Farnham.—A proposal before the U.D.C. to do the sewage pumping by electricity, whereby a saving of £52 a year could be effected, has been referred back for expert advice.

Greenock.—The electrical exhibition promoted by the Corporation proved a huge success, over 10,000 persons attending during the nine days it lasted. Already the electricity department is experiencing the benefit of its enterprise, as quite a number of new firms and householders are becoming consumers. At the closing ceremony last week Provost W. B. McMillan thanked Mr. Robertson, the Corporation engineer, and his staff, on behalf of the town, for the great amount of energy they had expended in making the exhibition a success.

Grimsby.—The application of the Admiralty to duplicate the supply of electrical energy at the wireless telegraph station at Cleethorpes by the provision by them of a self-contained plant at the station has been granted. In order to deal with the load for 1912-13, a motor-generator with an automatic booster, to work with one of the existing batteries on traction load, is to be installed at a cost of £900.

India.—Some details of the equipment of the new Kussara power station of the Bombay Tramways and Electric Supply Co. appeared in a recent issue of the *Indian Textile Journal*. The site has a frontage to the harbour and connects with the railway; it will allow of extensions up to 50,000-KW. plant capacity. The present boiler plant is provided with bunkers having a capacity of 2,500 tons, with a conveyor system connecting to a coal-crushing plant and receiving hoppers at ground level. The ashes are taken by a basement railway to elevators delivering to railway trucks. Sixteen Babcock boilers and four economisers are installed in connection with two 200-ft. steel chimneys. The generating plant consists of a 2,000-KW. turbo-generator and two 1,000-KW. engines and generators newly installed; also the following sets installed at Wari Bunder are being, or have been, transferred to the new building:—One 500-KW. and two 1,000-KW. turbo-generators, one 1,000-KW., one 300-KW. and two 500-KW. reciprocating engines and generators, giving an initial capacity of 8,800 KW. Provision has been made for the installation of three 700-KW. exhaust steam turbo-generators in connection with the 1,000-KW. reciprocating sets. The whole of this plant generates three-phase current at a pressure of 5,500 volts between phases. For condensing purposes the water of the Kussara Basin is drawn on, and the latter has been deepened so as to form a permanent reservoir of about 5,000,000 gallons. The larger units and groups of H.T. feeders are provided with remote-control switchgear, and the switches generally are installed on galleries along one side of the engine room. The engines and electrical equipment were supplied by the Brush Electrical Engineering Co.

Kedleston.—Subject to the sanction of the B. of T., the Derby T.C. has agreed to supply current to Lord Scarsdale at Kedleston Hall by means of overhead wires, at an outlay of £1,300, about half of which is guaranteed by Lord Scarsdale for his supply. In the application consent is sought to supply the parish of Quarndon, where current will be taken for over 20 large houses.

Largs.—The T.C. has received offers for a refuse destructor on a specification prepared by Mr. Robertson, the burgh electrical engineer for Greenock, the offers being by the Horsfall Co. (£2,490) and Messrs. Hennan & Froude (£2,897). Mr. Robertson is again to confer with the T.C. with regard to the tenders and to the provision of plant for working the stone-crushing machine, electric lighting, &c.

London.—Marylebone.—The Electric Supply Committee has recommended that as from the commencement of the next financial year (April 1st, 1912), a flat rate of 6d. per unit be adopted as part of the Council's tariff for electricity, and that all consumers adopting that rate may also have a special basement rate of 3d. per unit on the usual conditions. At present, reported the Committee, 1,930 consumers pay this flat rate, from them being obtained £32,970, or nearly 25 per cent. of the total revenue for private lighting. There are also 1,930 consumers who pay more than 6d. per unit, the value of income represented by payments in excess of 6d. being £1,850. The Committee did not think that a loss equal to £1,850 would be experienced. With regard to John Street dwellings the Committee recommended the following charges:—(*a*) 6d. per week per 25-C.P. Osram lamp in living rooms; (*b*) alternative to (*a*) 5d. per week per 16-C.P. Osram lamp; (*c*) 4d. per week per 25-C.P. Osram lamp in bedrooms; (*d*) alternative to (*c*) 3d. per week per 16-C.P. Oaram lamp in bedrooms; (*e*) alternative to (*d*) 2d. per week per 8-C.P. Osram lamp in bedrooms. The Committee further reported that it had decided to approach the owners of tenements to see if they would agree to similar arrangements to that of the John Street dwellings, and £500 of the revenue balance had been set aside to cover the cost of such work, which would be given out to contractors. The recommendations were adopted.

L.C.C.—At Tuesday's meeting of the Council, the question of the supply of electricity at Bermondsey gave rise to a great deal of discussion. The Bermondsey Borough Council asked for sanction of a loan of £18,563 for its electricity undertaking, £17,684 being for plant, &c.

Sir George Goldie reported that negotiations had taken place between the Borough Council and the two companies having powers of supply of electricity within the borough, for a supply in bulk. The Council, he said, refused to supply the County Council with information as to the supply in bulk, and sent an extract from a report by the borough electrical engineer, stating that, in his opinion, "the Council had not received an offer for bulk supply which would in any way compare with the advantage and economy derived from extensions of the plant of the Borough Council's undertaking."

The Finance Committee recommended that the sanction of the loan be refused on the ground of lack of necessary information.

Mr. Ecroyd, in moving the reference back of the report, stated that the B.C. had a right to refuse the County Council the information it asked for. The recommendation was a deliberate attempt to strangle municipal enterprise in the interests of privately owned companies. Mr. H. H. Gordon, a champion of municipal enterprises, supported the Committee's recommendation. The loan was refused.

Sir George Goldie, in moving the report of the Finance Committee dealing with electricity supply in London, said it was a very valuable one. Mr. H. H. Gordon said that it would be little short of a calamity to London if the consideration of the question were allowed to end merely in the reception of the report. The time must come when they would have to seriously deal with the question and determine the future of the electricity supply of London. Great difficulty would be experienced in linking up the electricity supplies, owing to the fact that private companies as well as B.C.'s

were working under different systems; he argued that the only means of obtaining a satisfactory solution of the problem was for the County Council to approach the companies and B.C.'s in the hope of getting a unification of the whole system for 1931. By way of inducement to the companies to come into agreement with the County Council after it had taken over the work of bulk generation, they might be allowed to work the distribution with the Borough Councils. He further contended that the County Council by appointing a Committee would be in a position to negotiate. Mr. Hayes Fisher, M.P., spoke on the great importance of the report, and agreed with Mr. Gordon with regard to the formation of a Committee to prepare some scheme which would be to the interest of the County Council and the ratepayers at large. The discussion was adjourned until the next meeting of the Council.

Merthyr Tydfil.—For the purposes of supply under the E.L. order, the Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for permission to use overhead lines for the transmission of current at a pressure of 11,000 volts. The lines will run from the generating station at Pennydarren to Treharris.

Mevagissey.—The P.C. has accepted the offer of the Electric Supply Co. to extend the overhead lines to Portmellin for public lighting purposes.

Monk Bretton.—The U.D.C. has acceded to an application from the Yorkshire Electric Power Co. for consent to the erection of overhead lines for the purpose of supply within the urban district. At the meeting, the chairman stated that the lighting question had been gone into thoroughly with the company, and it appeared that if the Council adopted electric lighting for the district, it would, on its present expenditure for gas, make a small saving.

Oldham.—The Electricity Committee has decided to install at Greenhill station a 1,200-KW. turbo-generator, to be driven by exhaust steam from the other engines at the works. The installation of the generator, which is expected to cost roughly £5,000, will enable the Committee to cope with the increasing demand.

Penmaenmawr.—The U.D.C. has had under consideration a report on the proposed electric lighting of the road from the entrance to the promenade up Paradise Road, as far as Clarendon Buildings in Pantyrafon, the estimated cost of the work being £160. After discussion, the matter was referred to the Roads and Improvement Committee.

Peru.—The Provincial Council of Huaraz is to arrange for the construction of a central electric generating station to supply the town of Huaraz and environs with electric light.

Radcliffe.—The U.D.C. has decided to extend the electricity works, and to this end an application will be made to the L.G.B. for sanction to borrow £17,000. A bulk supply is also proposed to be obtained from the Bury Corporation. In connection with this scheme, it is recalled that the Lancashire Electric Power Co., whose works are situated at Radcliffe, recently intimated that shortly it intended to ask for powers to supply electricity in the town.

Rugeley.—After discussing *in camera* a communication from the Ross Electric Lighting Co., the U.D.C. has decided to request Messrs. Drake & Gorham, of London, to report on the proposed electricity scheme for the town.

South Africa.—An electrical exhibition, promoted by the Electrical Committee of the Cape Town Corporation, was opened on October 23rd. The object of the Exhibition is to bring home to the public of the Cape Peninsula the advantages of the latest contrivances in electric lighting, heating, cooking and power. The exhibits have mostly been lent by the representatives of the electrical supply firms and by the local contractors. This is the first attempt at a local Electrical Exhibition, and it is hoped that it will lead to the increased use of electric energy for cooking and heating, as hitherto Cape Town has been somewhat backward in the adoption of electricity for anything outside lighting and motors.

The Municipality of Wynberg recently called for tenders for the electric street lighting and supply to consumers. These services have hitherto been rendered by the Cape Peninsula Lighting Co., Ltd., whose contract expires in September, 1912. The successful tenderer for the new contract is the Municipality of Kalk Bay and Muizenberg, the arrangement being to supply in bulk to the Wynberg Municipality by means of overhead H.T., three-phase cables. The distribution will be carried out by the Wynberg Municipality, the plant of the Cape Peninsula Co. being purchased at a valuation for that purpose.

The returns of the Ladysmith (N.) Electricity Undertaking for the year ended July 31st, 1911, show a revenue of £3,277 and an expenditure of £1,704, leaving a gross profit of £1,573, which, after paying capital charges, leaves a balance of £15 to next year. The units generated were 139,578, an increase of 11 per cent. on last year. There are now 223 consumers served by 7 miles of overhead mains. The capital expenditure to date amounts to £15,729.

Speldhurst.—The Tunbridge Wells T.C. has been approached with reference to a supply of current to this parish, residents having applied for a supply of electricity.

Stockton Heath.—With reference to the electric lighting scheme, the P.C. has approved a draft circular, to be issued to the ratepayers, giving the charges for electricity for power and lighting purposes. If there is a sufficient demand, the Mersey Power Co., Ltd., which has Parliamentary powers for supplying current within the rural district of Runcorn, will be prepared to extend its mains to the district.

Stratford-on-Avon.—The Stratford-on-Avon Electricity Co., Ltd., is holding an electrical exhibition at the Skating Rink, Wood Street, from November 20th to 25th, from 2 to 10 p.m. each day.

Tunbridge Wells.—The T.C. has decided to apply to the L.G.B. for a loan of £6,000 for mains and sevices for three years.

Whitworth.—The U.D.C. has had an interview with Mr. George R. Peers in connection with the scheme prepared by him for supplying electricity in the district for lighting and power purposes. A sub-committee was appointed to meet the Rochdale Electricity Committee to discuss the terms offered by that Committee for supplying electricity in bulk.

Winscombe and Axbridge.—The Winscombe E.L. and Power Co., Ltd., announces that its mains will be laid at Winscombe and Axbridge for the supply of current for lighting and power by December. For light, the charge will be 6d. per unit, and for power and heating, 3d.

TRAMWAY and RAILWAY NOTES.

Accrington.—On Saturday night a runaway Bacup tramcar, descending a steep incline known as Manchester Road, Accrington, almost two miles long, collided with another car, with disastrous results. The cars were smashed and 16 people hurt. Both cars were thrown off the metals, and looked little better than scrap iron. The cries of the injured passengers in the darkness brought speedy aid, and they were extricated as quickly as possible from the wreckage. Charles Geo. Whittaker, of Crawshawbooth, the conductor of the runaway car, was taken to hospital suffering from serious injuries. Both cars were the property of the Rawtenstall Corporation, who have running powers over the Accrington Corporation's lines, and the two Corporations, along with Haslingden, jointly work a through service from Accrington to Bacup, thus linking up Accrington, Baxenden, Haslingden, Rawtenstall and Bacup, a distance of 10 miles. The driver, Thos. Cuffe, of Rawtenstall, did his utmost to check the speed of the car going downhill with the magnetic brakes, but without the slightest effect. The runaway car crashed into an electric standard at the side of the road, and the top of the car, which was a double-decker, was torn completely off. The driver stuck pluckily to his post. The driver states that "the metals were greasy after the frost. The speed of the car was terriffic, and he could not stop it. But for colliding with the other car, the consequences would have been even more disastrous."

Argentina.—In reference to the agreement concluded between the Mayor of Buenos Ayres and the Anglo-Argentine Tramway Co. for the construction of underground tramways in that city, H.M. Legation at Buenos Ayres reports the commencement of work on a line running from the terminus of the Western Railway to the neighbourhood of the Docks. The work has been entrusted to a German firm. It has been arranged to construct three other lines, two of which will be begun before the first is finished. One is to be a prolongation of the line being constructed from the terminus of the Western Railway to a suburb about two miles further on; another is to run from the terminus of the Southern Railway to that of the Central Argentine, Pacific and Central Cordoba Railways; and the other from the terminus near the docks of the line under construction to the public park at Palermo.—*Board of Trade Journal.*

The Compania de Tranvias Lacrosse has, according to the *Frankfurter Zeitung*, applied for a concession to build an underground electric railway from Buenos Ayres to the harbour.

Blackpool.—The General Purposes Committee recently received the ex-tramway employés, who allege that they were victimised through their connection with their Union. The case for the men was put before the Committee by Mr. F. Eccles, and each of the six men was heard separately. Mr. Furness presented a comparative statement as far back as 1907, showing that at present the average wage per employé was 33s., compared with 28s. 3d. last year, 25s. 10s. in 1909, 24s. 7d. in 1908, and 25s. 7d. in 1907. The allegation that men had been discharged because of their connection with the Union, was denied, and it was pointed that at the end of each season a large number of men had necessarily to be discharged. After hearing the statements, the Committee unanimously passed a resolution approving of the action of the general manager in discharging the men.

Brazil.—The Government has signed a contract with the banking house of L. Dreyfus & Co., of Paris, to build a narrow-gauge electric railway from Retreito, province of Santa Catherina, to Lages.—*Elektro. Zeitschrift.*

Burley.—The U.D.C., after receiving a proposal by a company to introduce railless cars into the district, has decided to give permission for the necessary notices to be filed, but has reserved its decision on the matter.

Cheshunt.—The U.D.C. has under consideration the question of adopting a railless-trolley system of vehicles.

Doncaster.—It has been decided that the intended application to the Light Railway Commissioners for an order to extend the Corporation tramways to Brodsworth and Warmsworth be not proceeded with until next spring in order that arrangements may be made with various authorities which will be affected thereby.

Brentford.—At the last meeting of the Council a report from the surveyor was read with regard to the inspection of the tramway track by Col. Yorke. He (Col. Yorke) said that he could not declare the track dangerous to traffic, but advised the company's officials to carry out repairs at once where necessary. In some places along the line where remedies had been tried, he found them to be as bad as the defect. The chairman of the Council said that he was present during the inspection, and that the manager of the Tramway Co. said that he had never had any complaint addressed to him, and the first he knew about the matter was that the inspector was coming down. In view of other remarks passed by Col. Yorke, the inspectors of the Tramway Co. agreed to repair any portion of the road which was necessary.

Continental Notes.—ITALY.—La Società Italiana di Industrie Elettriche has secured the concession for the construction and working of a light electric railway from Spezia to Muggiano.

SPAIN.—La Société des Tramways de Barcelone has secured a concession for an electric tramway from Rambla de Cataluna to San Martin de Provensals.

AUSTRIA-HUNGARY.—A concession has been granted for the construction of an electric railway from Baden in the Helenental to Klausen-Leopoldsdorf. The line will be nearly 15 miles long, and the cost of construction is estimated at about £95,800.

Ealing.—At the last meeting of the T.C., the Highways Committee reported that, after receiving a deputation from the Chamber of Commerce advocating the establishment of a system of railless trolley cars fom Ealing Broadway to South Ealing, it was of opinion that it was impracticable to take any action that would enable the Council to obtain powers in connection with the matter in the next Parliamentary session, and that it should be instructed to consider the expediency of applying for powers the session following. Further, that the surveyor and the electrical engineer should be instructed to prepare a report relative to the comparative cost of railless trolley cars and motor-omnibuses (petrol and steam), both as regards the cost of installation, running and maintenance, together with alternative plans of the proposed routes. This was agreed to.

Fleetwood.—We are informed that a project is on foot for connecting up the Over Wyre district near Fleetwood, with Blackpool, by means of tramways to cross the River Wyre near Shard Bridge.

Haworth (near Keighley).—At a meeting of the D.C. a sub-committee was appointed to draw up a schedule of obligations under which the Council would be prepared to give its consent to the proposal of the Keighley Corporation to run railless trolley vehicles over certain roads in the Council's district. The conditions to be imposed are as follows:—(1) The Corporation to undertake to commence the service in the district within 12 months from the passing of the Act, failing which its powers would cease; (2) the Council to have the option of purchasing the undertaking on terms at the expiration of either 7 or 14 years, providing notice of its intention to do so is given to the Corporation within 12 months of the expiration of 7 or 14 years; (3) the service to be to the satisfaction of the Council as regards frequency, accommodation, fares, waiting rooms, and position of standards, while provision should be made for widening the highways where necessary. In case of difference on these points, the services of an arbitrator are to be requisitioned.

Glasgow.—As reported from time to time in the REVIEW, the delay which has been caused in the presentation of the Tramways Committee's report on free tramway travelling facilities for the blind, has been the cause of some heated scenes at the Corporation meetings by the members of the Labour section of the Council. The first remit was made to the Committee more than a year ago, and a full report has just been published. In the report, which embraces a period of over nine years, it appears that proposals to provide free travelling for the blind over the system were first made as far back as 1902, but it was not until November of last year that the general manager was instructed to supply, free of charge, to institutions for the blind, special tokens to be used only by blind persons travelling on cars within the city. Of the total of 560 blind, or partially blind, persons 406 were at present receiving a monthly supply of tokens, while 132 who filled up the necessary applications did not apply for the "permits," and the principle followed by the Committee in the distribution of the tokens was to give the afflicted people a sufficient supply to take them to and from work and give a few extra for week-end journeys. Some of the recipients were at present receiving from 5s. to 7s. worth per month. In connection with other tramway systems on which the blind had the privilege of travelling free, notably those of London and Manchester, it was pointed out as somewhat strange that the London County Council had only issued 100 passes. These passes were, of course, only granted to the necessitous blind, and were intended to enable the blind to travel on a specified route or routes to and from business. On the Manchester system 250 passes had been issued to the necessitous blind, and in West Ham only 13. The privilege had been granted in other towns, but the conditions under which the passes have been granted vary very much. The Committee did not consider a blind beggar who stood every day at a street corner begging from passengers as a necessitous person from the tramway point of view, and it contended that the vast majority of the blind were perfectly content with what was being done for them. The total value of the tokens presently used was from £450 to £500 per annum. The parent Committee has sent the report back for a further report upon what passes could be granted to blind people for free travelling on the cars.

The Tramways Committee has had before it the remit from the T.C. asking for a report on the advisability of arranging for a period of three months, that two of the present ½d. stages be given for ½d. In Committee it was moved and seconded that the remit be sent to the Sub-Committee for consideration and report, before December 1st next, while the amendment (which was defeated on a vote) asked that the question simply be remitted back for further consideration.

Kingswinford.—At the monthly meeting of the R.D.C., on Monday, Mr. Higgs pointed out that children's ½d. fares had been instituted on the Brierley Hill and Stourbridge section of the tramway, and he considered reduced fares should be brought into operation on the Kingswinford and Pensnett section also. He therefore moved that the company be written to asking for the concession; and at the same time that the agreement between the Council and the company as to running powers be brought before the next meeting of the Committee, in order to see whether the company was fulfilling its obligations.

Liverpool.—The public subscription fund for the loyal tramwaymen during the labour trouble is now closed, and it is proposed to distribute the amount equally among the employés, irrespective of rank.

There was a somewhat exciting scene at the meeting of the Tramways and Electric Light and Power Committee on November 10th. Councillor Max Muspratt took exception to the proposal to re-elect Alderman Fred. Smith as deputy-chairman, on the ground that the whole attitude of mind of Alderman Smith, where labour troubles were concerned, was a constant danger to the peace and goodwill of the city. On a vote Mr. Smith was re-elected, four voting against. When the sub-committees were chosen, an attempt by Councillor Gates to divide the electric supply and the tramways departments was unsuccessful

Middlesbrough.—A scheme is being prepared to link up Middlesbrough, North Ormesby, Cargo Fleet, South Bank, Grange Town, Normanby and Eston by a railless traction service. The project has been brought about largely by the fact that in its recent Parliamentary Bill the local tramway company failed to secure an extension of time for the completion of its long-projected scheme to extend the tramway service to South Bank and Grange Town. A syndicate has been formed, backed up by the owners of large works, and Messrs. Jackson & Jackson, of Middlesbrough, solicitors for the promoters, have addressed a letter to the North Ormesby U.D.C., intimating that Parliamentary powers are to be sought to carry out the scheme.

Mid-Lothian.—At a meeting of the Suburban District Committee of the County Council the question of tramways to Corstorphine and other places in the neighbourhood of Edinburgh was raised, and after discussion it was decided that the District Committee should give every reasonable facility for tramway extensions.

New Zealand.—The New Zealand Minister of Finance announced, in his financial statement, that plans were being prepared for the electrification of the railway through the Lyttelton Tunnel, with a view to the work being put in hand at an early date.

North London Railway.—The *Financial Times* states that the directors of this company have definitely decided to electrify their system. This step was agreed to at a board meeting on Wednesday, and it is anticipated that the work will be taken in hand immediately.

Nottingham.—In his report on the tramways department accounts of the Corporation for the year ending March 31st last, Mr. Walter Garth, one of the city auditors, stated that he was strongly of opinion that the tramways department should be supplied with current at the rate of 1d. per unit, as it provided a constant day load customer, added to which there was no difficulty or risk in collecting the account. This year ½d. per unit would make a difference of £5,918. This amount would be of considerable importance to the tramways department, and the reduction would not injure the electricity department, as that undertaking had now obtained the limit of its reserve fund. Its surplus interest amounted to £1,090, whilst its general surplus of assets for repayment of capital and for renewals were equal to 41·28 per cent. of its capital expenditure (the electricity department being in this respect the most favoured of any of the trading undertakings) whereas the tramways department had but 38·88 per cent. Although the amount added to the reserve fund was not up to the standard of the requirements of the fund, yet it was satisfactory to note that £3,817 had been carried to the credit, being an increase of £2,068 on the previous year.

Panama.—The U.S. Government is calling for bids for 40 electrically-driven locomotives required for towing ships through the locks at Gatun, Pedro Miguel and Miraflores, Panama Canal. The system of towing provides for the passing through the locks of a ship at the rate of 2 miles an hour, the vessel being held steady by four hawsers. A ship will come to rest in the forebay of the locks and four hawsers will be attached, two forward on either side and two aft. These hawsers will lead to the windlasses of four towing locomotives operating on the lock walls, two towing forward, and

the two aft being towed by their hawsers. The locomotives will run on a level, excepting where they pass from one lock to another, where they will climb or descend heavy grades. There will be two systems of tracks, one for towing, and the other for the return of the locomotives. After hauling a ship through the last gates, and into the forebay, the locomotives will coil their cables and return to await another ship, or will take hold of a vessel going in the opposite direction and tow her through.

South Africa.—Messrs. W. Spilhaus & Co., of Cape Town, have made application to the T.C. for a concession enabling the construction of an aerial railway up Table Mountain. They suggest a route from Oranjezicht or Rocklands, and propose electricity as the motive power, and have asked the Town Council to state at what rate it will supply current. The concession is asked for up to the end of 1912.

Tunbridge Wells.—The T.C. has informed the Parliamentary agents of a company that it does not view with favour a proposal to construct a railless traction route in the borough and between the town and Southborough.

West Hartlepool.—At a meeting of the T.C. on the 7th inst., the Mayor moved a report of a special meeting of the Tramways Committee which recommended the payment of the sum now due to the Tramways Company, and this was adopted. Another report of the same Committee was submitted, and Mr. Paterson, in moving its adoption, said it was proposed to apply for powers for constructing additional lines. These would be laid in Lynn Street, Musgrove Street, York Road, Elswick Road, Hart Road and Hart Lane. The Park section which the T.C. had acquired was in a bad condition, and it was recommended to advertise for tenders for its reconstruction. This work the borough engineer estimated would cost £4,000. The report was adopted.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government has decided to build a wireless station on New Year's Island, off the south coast of Tierra del Fuego, in order to assist the German South Polar Expedition, under Dr. Filcher, during the stay of the *Deutschland* in the Weddel Sea.

France.—In addition to the existing stations, wireless posts are being erected at Monrovia in Liberia, at Timbuctoo in New Guinea, at Fort Lamy and at Abecher, the last named to be connected with a station at Djibouti which is projected. Madagascar is to be connected with the island of Reunion and the Comorra Islands, which latter will thus be able to correspond with Djibouti. The French Indo-Chinese possessions are also to be linked up by wireless stations with French colonies in the Indian Ocean. In the West Indies, Cayenne is to be put in connection with Martinique and Guadeloupe, and communication will also be arranged for between New Caledonia and other French possessions in the Pacific. These various stations, linked together, will form a complete system united to Paris by means of the central station at the Eiffel Tower. —*Journal des Postes.*

Germany.—The Bremen firm of Lehnkering & Co. has decided to set up a novel telephonic arrangement for direct communication with its ships immediately on their arrival off the port of Bremen. A submarine cable is to be laid from the company's office to a point in the outer harbour. Here the ships' captains will be able to notify their arrival and receive orders as to loading and the like without leaving their ships.—*Elek. Nach.*

The wireless station which is shortly to be opened at Königsberg for the public service will make the seventh under the control of the Imperial Telegraph Department, the other stations being at Danzig, Swinemünde, Norddeich, Kuxhaven, Heligoland and Sylt. The public may make use of these stations through the Postal authorities.

Hythe Telephone Dispute.—In accordance with a promise to the T.C., the Post Office authorities have commenced installing an underground system of telephone cables, to dispense with the route running through the Mayor's Avenue and the Grove.

Russia.—The Russian Government is erecting a wireless station on the Island of Rano, 110 km. from the shore of the Riga Sea, for communication with ships and the mainland. A coast station is also to be set up on the Finnish coast near Reval.

State Telephones.—Among countries whose telephonic systems are wholly or partly worked by the State, Germany takes the leading place as regards the total of receipts. According to the latest statistics, those for 1909, the aggregate income from the three telephone administrations amounted to 161,500,000 fr. England, which occupied the second place, had a total of only 44,000,000 fr., and France had 43,000,000 fr. The income of no other country reached to as much as 20,000,000 fr.

U.S.A.—The Public Service Commission of New York State has decided a fight which has been going on before that Commission between the Postal Telegraph Co. and the Western Union Telegraph Co. for a year and a half past; the decision is in favour of the former. The Commission decides that the Western Union has been practising discrimination against the Postal, and has ordered that it be stopped. It appears that where the Postal Co. has a message destined to a point not reached by the Postal lines, the company has carried it as far as it could, and then turned it over to the Western Union for final transmission and delivery, and the Western Union has insisted that from three to five words be added to the message, and that the Postal Co. pay for the transmission of those additional words. The Public Service Commission now decides that this is an illegal charge, and orders the Western Union to discontinue it. The decree says: "Clearly a public service corporation must extend precisely the same facilities to a competitor as it does to the entire world; it can make no distinction between those offering it business. It must charge them alike, and serve them alike." This decision may have an important bearing on the demand of the independent telephone companies that the Bell companies shall furnish the former with the same facilities which are furnished to the public; it means a large saving of money to the Postal Co.

Wire Thefts.—The northern suburbs of Paris have been the scene for months past of extensive robberies of telegraph and telephone transmission lines, which have been cut over long distances and removed. The police have concluded that these thefts are the work of professional thieves. Domiciliary visits to the shops of second-hand dealers have resulted in the recovery of over 50,000 kg. of wire and the implication of some 54 dealers as receivers.—*Journal des Postes.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

December 12th.—Ebonite earpieces, telephone cords, bronze and copper wire, Bleeck-Love cells and charges, and telephone material, for the P.M.G.'s Department. See "Official Notices" October 20th.

Belgium.—December 5th. The Secrétariat Général de l'Administration des Hospices, of Brussels (Boulevard Botanique, Hopital St. Jean), is inviting tenders for the supply and installation of two electrically-operated lifts in the St. Pierre Hospital, Brussels.

November 27th.—The municipal authorities of Fleron-lez-Liége are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes.

Belgrade.—November 27th. The Directors of the Servian State Railways at Belgrade are inviting tenders for the supply of electrical material for the national mine at Szenje. Reference No. 38,238/11. Guarantee, 800 fr.

Blackpool.—November 29th. One 1,500-kw. steam turbo-alternator, one barometric jet condenser, and one 800-kw. mixed-pressure steam turbo-generator, for the Corporation. See "Official Notices" November 10th.

Darlington.—December 4th. 500-kw. d.c. dynamo coupled to a reciprocating steam engine, for the Corporation. See "Official Notices" to-day.

Dublin.—November 21st. Electric lighting and fire-signalling apparatus for the new Fire Brigade station. See this column in our last issue.

Kenfig Hill.—November 20th. Lighting of Kenfig Hill and district by electricity or gas, for the Penybout R.D.C. Particulars from T. Thomas, New Cottage, Pyle, near Bridgend.

London.—November 18th. Various stores and materials for the Port of London Authority, including: Item 27, carbons for electric arc lamps; Item 28, electric lamps (carbon filament). Stores Superintendent, 106, Fenchurch Street, E.C.

Hammersmith.—November 22nd. Low-tension service cable, for the B.C. See "Official Notices" to-day.

Fulham.—November 22nd. Transformers, for the B.C. See "Official Notices" to-day.

Neath.—November 25th. Small steam coal for a year, for the electricity generating station of the R.D.C. G. H. Thomson, electrical engineer, 12, Green Street, Neath.

New Zealand.—February 7th, 1912. Napier Corporation. (1) Permanent way, overhead work and supply mains; (2) power station, car-shed and repair-shop equipments; (3) rolling stock. Deposit 2½ per cent. Specifications can be seen at the Board of Trade Commercial Intelligence Branch in London.

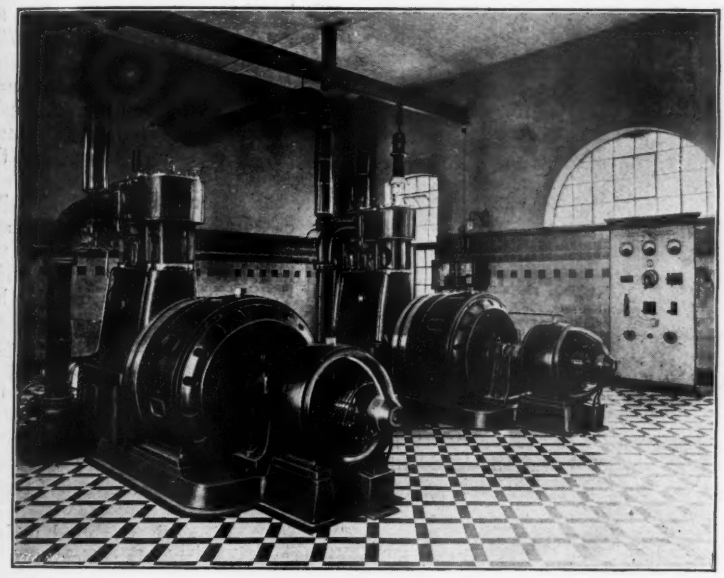
Norwich.—November 27th. Two water-tube boilers, for the Corporation Electricity Department. See "Official Notices" to-day.

(*Continued on page* 831.)

RECENT DEVELOPMENTS OF THE "SCHORCH" INDIVIDUAL DRIVE SYSTEM IN ENGLISH AND COLONIAL TEXTILE MILLS.

By W. R. ROTHENBERG, A.M.I.E.E., Member of the Textile Institute.

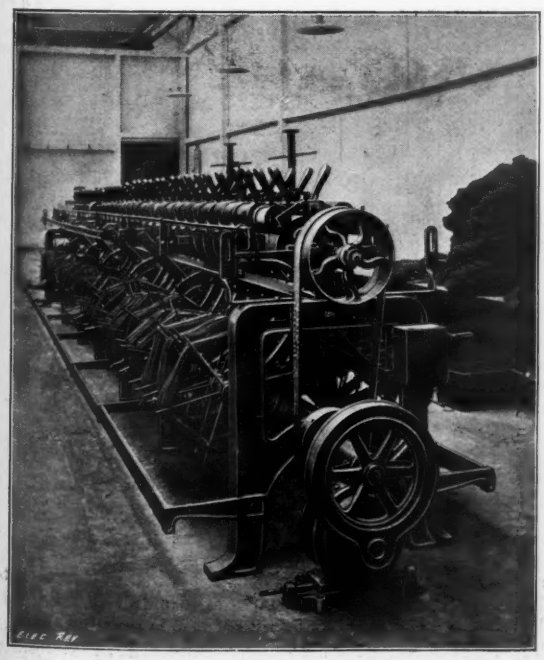
It is not very long ago that it was necessary to write lengthy articles and undertake prolonged and earnest missionary work to secure even a scant and tardy recognition of the benefits of electrical driving in textile mills. The claims of advantages which are made for electrical driving, viz., absolute steadiness of speed, increased output, saving in power, and all-round improved financial results have been discussed frequently, and as these are now daily proved in large English textile mills, it is not necessary to go fully into this matter. This article is only intended to show that electrical driving of textile machinery is by far the best method, and that it will in the future be adopted for all new mills, extensions, and in cases where the mechanical drive must be changed on account of alterations in the mills, &c.



Three-phase Power Plant for a Mill in N. Wales.

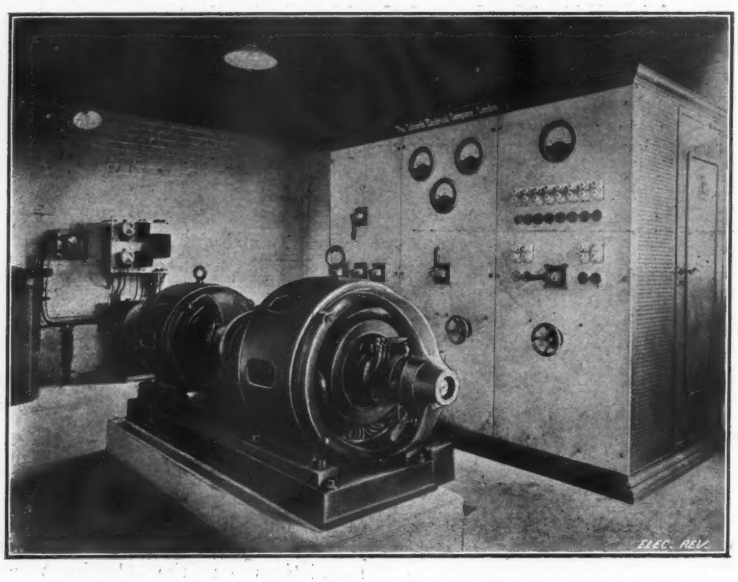
The chilly reception given to the pioneers of the so-called group drive system was perhaps easily to be explained by the many disadvantages in the system itself, but it was warmth itself compared to the attitude that was at first taken up in this country about three years ago towards the so-called single-drive system and its exponents. Earliest in this field was the Schorch Electrical Co., who, after having carried out within the last eight to ten years a great number of single-drive installations on the Continent and abroad, thought to introduce the same to the English textile manufacturers.

Progress at first was very difficult. Not only had the well-known conservatism to be broken through, but also an amount of prejudice which had been raised in many quarters by the failure of early experimenters in electrical single-driving. These were due to the electrical engineer's ignorance of weaving and spinning conditions, and the lack of suitable apparatus. In putting down electrical installations in textile mills in this country electrical engineers and contractors did not appreciate the very important point that for a textile mill only three-phase alternating-current is of use; it was thought to be quite good enough to install open direct-current motors to drive spinning frames, looms, &c., and many early experiments ended in disaster owing to the open character of the direct-current motors and the constant variations in speed and irregularity of the drive.



Examples of Winding Frames Driven by Schorch Motors, Through Back Gearing and Direct.

Furthermore, the fact was overlooked that the conditions under which electric motors have to work in spinning and weaving mills are not at all favourable to the use of direct-current motors fitted with commutators and brushes. Dirt and dust are soon deposited, causing sparking of the brushes, &c. As a rule, every available foot of floor space is taken up by machinery,



Schorch Motor-Generator Set (Single-phase to Three-phase), with Exciter, for Lancashire Weaving Shed.

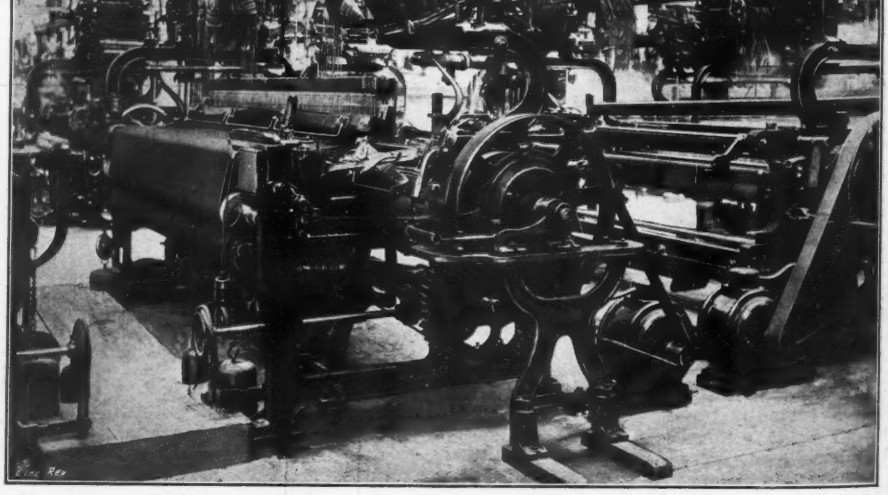
and it is, therefore, necessary to fix motors in the most convenient positions, say, to the walls, ceilings, &c., and thus the motors cannot receive the regular and frequent attention required by direct-current machines. The three-phase alternating-current induction motor only requires attention every few months for the purpose of inspecting the bearings, and may, therefore, be quite properly fixed in such places. It is a recognised fact that all textile machinery must have constant and uniform speed, and in this very important point the direct-current motor has inherent defects. The alternating-current motor will run with absolutely constant speed; the direct-current motor will vary in speed even with an absolutely uniform load. In a case in the Bolton district where the writer carried out exhaustive experiments in a large mill to show the increased and improved production to be obtained when driving a number of looms by separate three-phase motors, there was no three-phase alternating-current available, and it was necessary to install a small three-phase generator which was run from a shaft driven by a 70-H.P. direct-current motor. The speed of the loom motors connected to the three-phase generator was found to be fairly satisfactory in the morning, but in the afternoon the speed was exceeded from 5 to 10 per cent.

This was easily explained by the fact that the field coils of the direct-current motor got heated up in the afternoon, and the speed of the motor was, therefore, considerably increased. The mill manager, therefore, did not believe the statements made as to the constant-speed drive. At that time a new independent large three-phase power station for this mill was completed, and when the tests were continued in connection with it, not only the constant speed of the loom motors was admitted, but also the increased and improved production, and finally the directors decided to install single-drive three-phase motors in their new weaving shed right through.

It might be mentioned here that this is one of the largest textile mills in this country—Messrs. Barlow & Jones, Ltd.—and that this single-drive installation has now been running for some time with entire satisfaction. With regard to the three-phase alternating-current system, it is of the greatest importance to employ for the individual drive only totally-enclosed motors fitted with ball bearings and of the highest efficiency.

The early failures due to the installation of direct-current motors and open three-phase motors in mills, undoubtedly raised an amount of prejudice in this country, which even yet has not been removed, but the Schorch Electrical Co. were prepared to conquer where others had failed. Owing to their works being situated in the heart of the German textile industry, they had been able to study the conditions intimately, and carry out a long and costly series of experiments in connection with the driving of all classes of textile machinery.

The result was two-fold. First, they evolved modern totally-enclosed spring-suspended highly efficient loom motors and other larger type totally-enclosed textile motors for the individual drive of mules, winding frames, &c., and,



Coating Looms, Individually Driven in a Yorkshire Weaving Shed.

secondly, the electrical textile expert who, in addition to being an electrical engineer, possesses a full and intimate knowledge of the scientific side of textile machine driving. The latter is almost, if not quite, as important as the former, because in weaving, for instance, there are so many different sizes and classes of looms, that any one of a dozen different

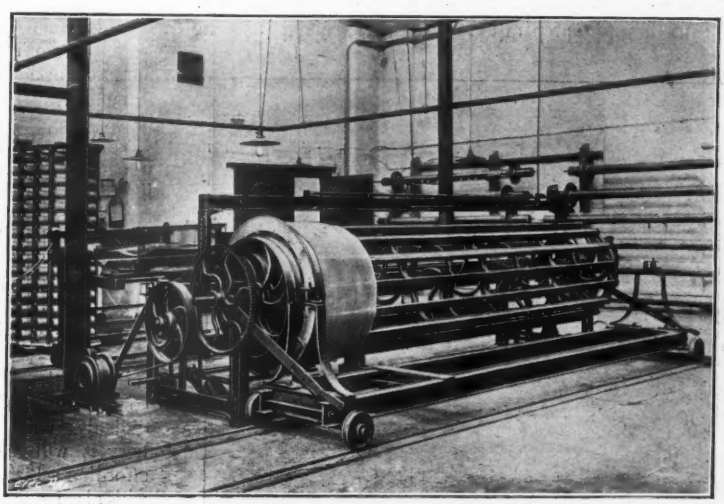
ways of driving may be the correct method, and any of the other 11 would spell absolute failure, even with the same efficient driving machine. Even then the converts to the "Schorch" system were very shy of coming forward.

The first probably in the cotton manufacturing trade were Messrs. James Orr and Sons, Ltd., who considerably extended their single-drive installation. Another of the early firms to adopt the "Schorch" single-drive system were Messrs. J. H. Binns & Co., Ltd., Devonshire Mills, Keighley, who put down about 150 loom motors for the single driving of heavy coating looms, also totally enclosed three-phase motors for the individual driving of all their preparation machinery, such as sizing machines, dressing frames, &c. This installation has been working now for about 1½ years, and is giving perfect satisfaction.

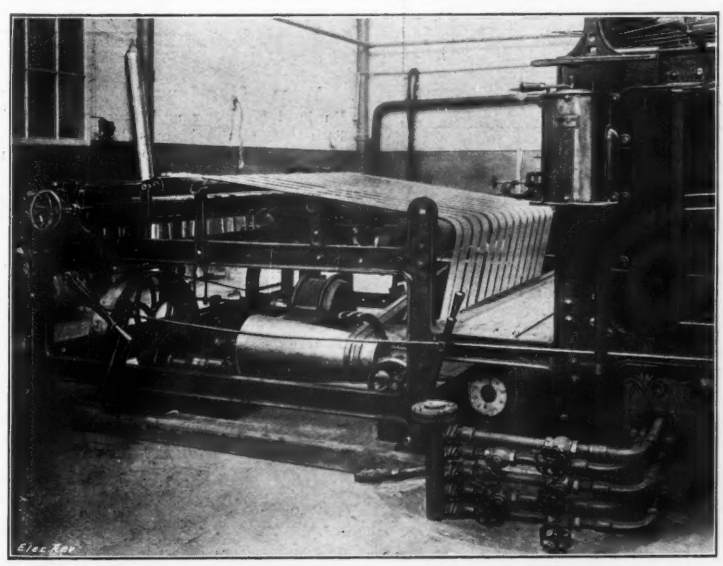
It is especially noteworthy that the owners of the mill state that the upkeep of the plant is practically nil compared to their previous mechanical shafting drive. They freely admit having an increased production of 6 to 8 per cent., which is verified by the fact that all their weavers earn a few shillings more per week since they have changed from shafting drive to electrical individual drive.

After the first few installations when the "Schorch" single-drive system could be seen working, the great benefits claimed were found to be actually obtained, the early hostility was to an extent reduced, and the Schorch Electrical Co. received a large number of orders in this country for their special electrical textile installations. With regard to the development of the electric single-drive system in cotton mills in India, it will, no doubt, be of interest for readers of this article to hear that in accordance with specification issued by Mr. A. N. Robinson, two large spinning mills in Gokak, India, will be fitted up with single-drive motors (about 500) right through. The spinning frames will be, in this instance, driven by the variable speed Oerlikon single-phase commutator motors, while all the other machinery, *i.e.*, roving frames, slubbing frames, intermediate frames, openers, &c., about 250 in number with the exception of the cards, will be driven singly by totally-enclosed ball-bearing Schorch three-phase motors. With regard to the cards, which require a great amount of power for starting and very little power while running, it has been arranged to drive the shafting for these, running at 260 R.P.M., direct from a motor.

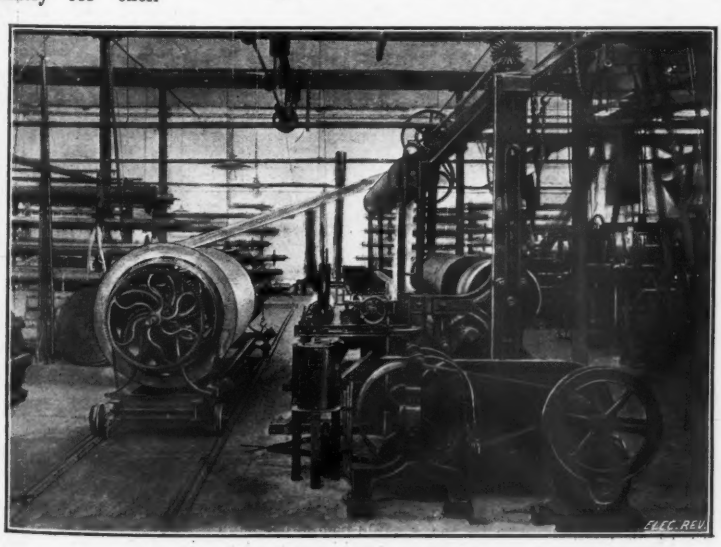
There is, so far, not a single individual drive installation for a complete English spinning mill although there are a few single drives of spinning frames and self-acting mules, so the above-mentioned installation in India will be the first of its kind. These two Indian spinning mills are a present shaft-driven, and, of course, the whole of the shafting will now be removed. The progress that has been made may be judged by the very large orders that have been executed during the past three years, or are in hand at present for this single-drive system. In some instances, hundreds of



The Individual Drive in a Lancashire Mill.

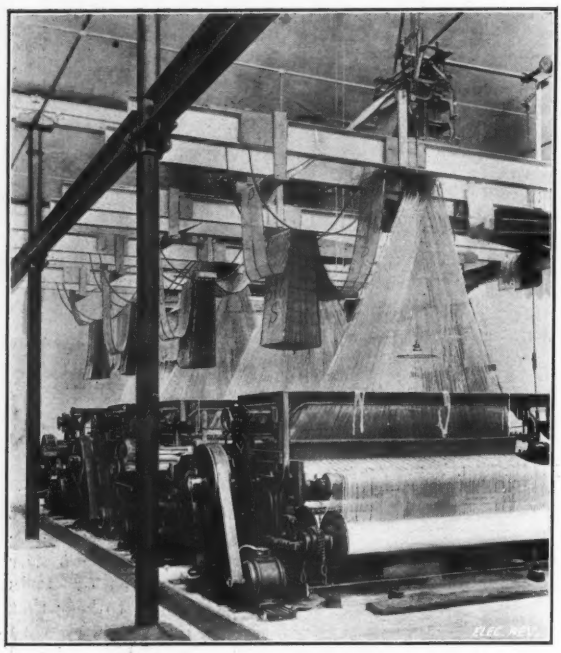


Sizing Machine with Schorch Totally-Enclosed Motor Drive.



Winding Machine with Schorch Motor Drive

three-phase textile motors are being supplied, in the Bolton, Manchester, Huddersfield, West of England textile area, for some of the most important concerns. In addition to these the whole of the loom motors and three-phase motors for preparation machinery, about 350 in



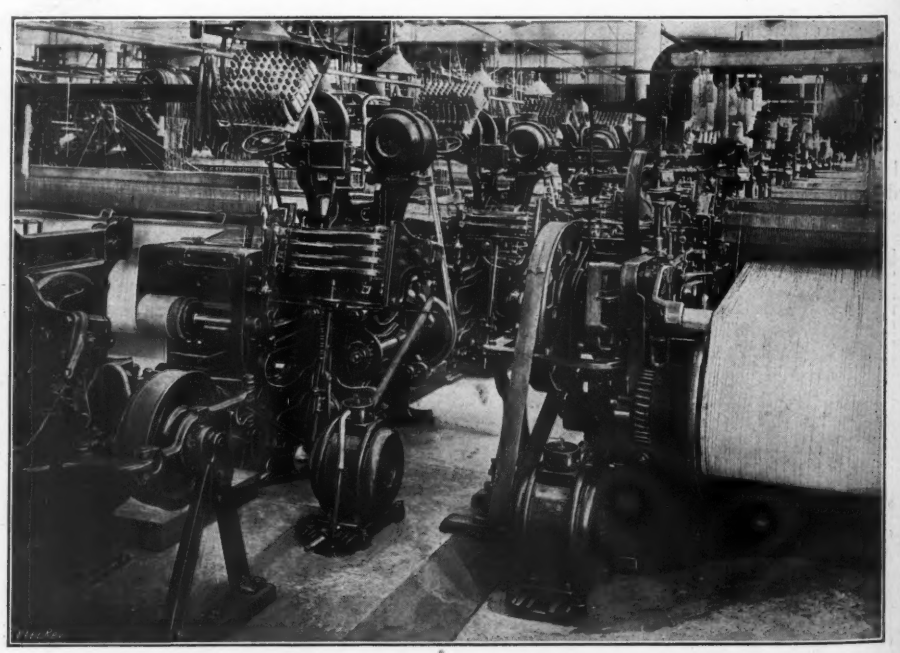
Quilt Looms fitted with Jacquards, Individually Driven by Schorch Motors.

number, for the new weaving shed in Radcliffe for the Co-operative Wholesale Society, Ltd., are now being made by the Schorch Electrical Co., who have been entrusted with this order.

A few installations on the single-drive system have been carried out by other firms who have been keen to follow where the prospects of business were so good.

And what of the future? The time is surely gone by when each prospective buyer will have to be dragged over the same old weary ground and finally insist on the scheme being tried in his own mill, to see whether it will work. After the number of important installations, of which a few significant illustrations are given, showing Schorch textile motors driving looms and other machinery in English textile mills, that have now been running for some time, the manufacturer may be legitimately expected to take the success of the scheme as being assured, and when once this is the case the road to rapid extension will be clear. As a matter of fact, there are signs of an approaching period of great electrical expansion both at home and abroad which will bring plenty of work. The contracts in hand and the prospects furnish a very encouraging outlook. The writer believes that the improvement is going to continue unless labour restlessness, which is becoming more and more threatening, takes the worst course. The adverse electrical competition in this country has been due to there not being enough work to go round. Manufacturers built new electrical factories and extended others when the period of slacker demand, which was not anticipated by anybody, was close at hand.

Under such conditions as those, attempts to enter into an understanding for the prevention of price cutting were not so likely to be successful as when more work was available; therefore, in presence of the improved prospect, the writer cannot help regarding the present as a most opportune moment for a new attempt to be made, whereby all-round better prices shall result. When one takes into consideration the vast ever-expanding prosperous textile industry in this country, the very large sums spent generally in new mills, extensions, renewals and alterations, it would seem that at least the future of the electrical textile business is great beyond all computation; although the early work has been costly and difficult, yet the writer has every confidence that the harvest will be adequate, and the result, in addition to affording selfish satisfaction to the electrical manufacturers, will place our great textile industry on a higher plane of efficiency all round, which will doubtless have a most beneficial effect in helping us to maintain our place as the greatest textile power in the world.



Dobcross Looms with Schorch Single Motor Drive.

West Hartlepool Exhibition.—At the North of England Shipping and Engineering Exhibition, which opened on 13th inst., at the Queen's Rink, West Hartlepool, the Combination Metallic Packing Co., Ltd., have an exhibit of their leading manufactures.

A Non-Ferrous Metals Exhibition.—The first meeting of the Vice-Presidents and Hon. Advisory Council of the above Exhibition was held at the Holborn Restaurant on Wednesday last week. The President of the Exhibition, Sir Gerard Albert Muntz, Bart. (President of the Institute of Metals) was in the chair. Mr. F. W. Bridges is the organising manager of the Exhibition, who, after the chairman had referred to the origin, scope and objects of the Exhibition, explained that the show would be of a threefold character—it would show non-ferrous metals from the crude ore up to the finished article, and the various purposes to which non-ferrous metals could be applied; and a wider knowledge would be conveyed of the machinery employed in turning out the goods. The Exhibition takes place at the Royal Agricultural Hall, N., from May 6th to 18th, 1912.

CONTRACTS OPEN.

(*Continued from page* 826.)

North-Eastern Railway.—November 21st. Various materials for 6 or 12 months, including the following sections:—No. 25, arc lamp carbons; No. 26, electric lamps; No. 27, electric wires and cables; No. 27A, electric lighting, sundry fittings; No. 33A, glasses for electric arc lamps. E. H. Clark, Stores Superintendent, Gateshead.

Telegraph stores (apparatus, and wire and line stores) for 6 or 12 months. C. H. Ellison, Telegraph Superintendent, York.

Norway.—January 31st, 1912. The Norwegian military authorities in Christiania are inviting tenders for the supply of 100 sets of field telephone apparatus.

Salford.—November 27th. Two 1,000-KW. direct-current turbo-generators, for the Corporation. See "Official Notices" November 3rd.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Spain.—December 6th. Tenders are being invited by the municipal authorities of Pedro Bernardo (province of Avila), for the concession for the electric lighting of the town during a period of 20 years.

November 29th.—The municipal authorities of Malagon (province of Ciudad Real), are inviting tenders for the concession for the electric lighting of the town during a period of six years.

Tenders have just been invited by the municipal authorities of Valenzuela (Province of Cordoba), for the concession for the electric lighting of the town during a period of 10 years.

Swindon.—November 22nd. One 250-KW. Diesel oil engine generating set, accessories, switchgear, &c., for the Corporation. See "Official Notices" November 3rd.

Uruguay.—February 6th, 1912. Tenders are invited by the Port Authorities at Monte Video for the supply of 13 electric cranes, together with 600 metres of steel rails. For further particulars, see this column for October 27th.

Warrington.—November 28th. Low-tension cable, for the Corporation Electricity Department See "Official Notices" to-day.

West Ham.—December 4th. Electric light installation at the Gainsborough Road Schools, for the Corporation. See "Official Notices" November 10th.

CLOSED.

Ashton-under-Lyne.—The Electricity Committee has accepted the tender of the Sutcliffe Ventilating and Drying Co., Ltd., for two ventilators for the roof of the engine room.

Ballinamallard (Co. Fermanagh).—The contract for the lighting of the village by electricity has been given to Mr. John S. Loughnan, of Bundoran. It includes water turbine, dynamo, switchboard and overhead mains.

Barrow-in-Furness.—The T.C. has accepted the tender of Messrs. George Robson & Co. for six coal-bunker chutes at the electricity works, at £184.

Bradnich.—The Electric Supply Co. has placed an order with the Tudor Accumulator Co., Ltd., for a new battery.

Durban.—The Corporation, acting under powers lately granted to municipalities to supply electric current outside their respective boundaries, is erecting an E.H.T. overhead line, supplying three-phase at 6,600 volts, for Messrs. Storms & Co.'s brickworks, situated about five miles from Durban, and requiring about 600 H.P. The contract for the electrical plant for the brickworks (according to our Durban correspondent) has been secured by Messrs. T. Barlow & Son, and is for the supply and erection of the following:—

Two 250-K.V.A. Westinghouse oil-type transformers, three-phase, 6,600 to 500 volts, 50 periods.
Two H.T. Westinghouse switch pillars to control H.T. side of transformers, each fitted with three-pole oil circuit-breakers with overload releases.
Two 312-B.H.P. Westinghouse A.C. slip-ring motors, three-phase, 50 periods, 500 volts, at a speed of 585 R.P.M.
Two Westinghouse liquid starters; also the necessary ammeters, circuit-breakers, &c.

Glasgow.—The Tramways Committee of the T.C. has recommended the following offers for acceptance:—

Steel poles.—Stewarts & Lloyds, Ltd.
Oil-proof cable.—I.-R., G.-P. and Telegraph Works Co., Ltd.
Steam dust-extractor.—Hydro-Vacuum, Ltd.
Copper bonds.—R. R. Todd.
Copper strip.—Charles Henderson & Co.
Lead-covered cables.—British Insulated and Helsby Cables, Ltd.
Armature coils.—Manchester Armature Repair Co.

The offer of Messrs. Mirrlees, Watson & Co. for the condensing plant for the new turbine at Pinkston power station has also been accepted.

London.—L.C.C.—The tender of the Stern Sonneborn Oil Co., Ltd., for the supply of cylinder oil for Greenwich generating station for one year, at 1s. 1½d. per gallon, has been accepted.

STEPNEY.—The B.C. Electric Supply Committee has accepted the tender of Messrs. R. A. Bradshaw & Son, at £52, for six arc lamp columns; also the tender of Messrs. W. T. Henley's Telegraph Works Co., Ltd., at £60, for rubber cable.

Northampton.—The T.C. has accepted the tender of Messrs. Wiggins & Co. for the annual supply to the tramways power station of 1,600 tons of Griff peas, at 9s. 8d. per ton.

Southampton.—The T.C. has accepted the tender of Messrs. Playfair & Toole, at £3,145, for extending the car depôt at Portswood.

Stoke-on-Trent.—The B. of G. has accepted the tender of Messrs. Blackburn, Starling & Co., of Hanley, for electric wiring work.

Swansea.—The Harbour Trust on Monday accepted the following tenders:—

Crompton & Co.—Motor and pump, £108.
Ward, Haggis & Smith.—Radial drilling machine, £145.
Isca Foundry Co.—Points and crossings, £143.

West Bromwich.—The T.C. has accepted the tender of Cox-Walkers, Ltd., for a Taylor-Scotson automatic potential regulator for controlling the voltage on a 1,000-KW. generator.

Yarmouth.—The Borough Education Committee has accepted the tender of the Borough Electrical Engineer for installing auto-transformers and metal-filament lamps at the Edward Worlledge School, at £30.

York.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Barber, Walker & Co., of Bentley Colliery, Doncaster, for coal for the works for a year, at 7s. 10d. per ton.

FORTHCOMING EVENTS.

Illuminating Engineering Society.—Friday, November 17th. At 8 p.m. At the Royal Society of Arts. Report on progress during the vacation, and paper on "Notes on the Design of Motor-Car Headlights," by Dr. H. R. B. Hickman.

Northampton Institute Engineering Society.—Friday, November 17th. At 5.45 p.m. Paper on "The Design of Electric Power Stations," by Mr. A. H. Perrett.

Junior Institution of Engineers.—Saturday, November 18th. At 3 p.m. Visit to the works of the Tottenham and Edmonton Gas Light and Coke Co.

London Electrical Engineers' Club.—Saturday, November 18th. At 7.30 for 8 p.m. At the Café Monico. First annual dinner. Members should apply to the Hon. Sec. at once for tickets.

Electro-Harmonic Society.—Monday, November 20th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' Night.

Institution of Civil Engineers.—Tuesday, November 21st. At 8 p.m. Further discussion on papers on "The Loch Leven Water-Power Works," and "The Hydro-Electric Plant in the British Aluminium Co.'s Works at Kinlochleven."

Royal Society of Arts.—Wednesday, November 22nd. At 8 p.m. Paper on "The Industrial Progress of the United States of America," by Mr. J. Douglas.

Institution of Electrical Engineers.—Thursday, November 23rd. At 8 p.m. Paper on "Automatic Reversible Battery Boosters," by Mr. R. Rankin.

Physical Society.—Friday, November 24th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Maximum Value of the Electric Stress between Two Unequal Spherical Electrodes," by Dr. A. Russell; "The Magnetic Transition Point of Cementite," by Messrs. S. W. J. Smith, W. White and S. G. Barker, and other papers.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

The following orders are issued:—

Friday, November 17th.—"D" Company. Lecture, 7 p.m. Technical work and infantry drill, 8 to 10 p.m.

Saturday, November 18th.—Social Club annual dinner, at 7.30 p.m., at the Café Monico.

Monday, November 20th.—"A" Company. Technical work and musketry instruction (standard tests), 8 to 10 p.m.

Tuesday, November 21st.—"B" Company. Lecture to engine-drivers, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Wednesday, November 22nd.—Gymnastic classes, 7 to 10 p.m.

Thursday, November 23rd.—"C" Company. Lecture, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Friday, November 24th.—"D" Company. Lecture, 7 to 8 p.m.; technical work and standard tests, 8 to 10 p.m.

Saturday, November 25th.—Probable run at Coalhouse Fort, Gravesend, for "C" Company.

There will be a week-end mobilisation camp at Dover for "A" and "B" Companies, leaving Victoria Station at 1.30 p.m. on Saturday, December 9th.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjt. L.E.E.

Fatal Accident.—Frederick Harwood, 36, Tipton, was on Monday working on the roof of the electric power station at Ocker Hill, when he fell to the ground. He sustained fractures of the skull and right arm, from which injuries he died the same afternoon.

NOTES.

Financial Success of Olympia Electrical Exhibition.—Mr. Hawes, secretary of the Executive Committee of the Olympia Electrical Exhibition, informs us that it has been resolved, subject to audit of the accounts, to return to exhibitors approximately 20 per cent. of the space money.

The Kjellberg Electric Welding Process.—On Friday last, through the courtesy of the Kjellberg Syndicate, Ltd., we were enabled to witness a practical demonstration of the Kjellberg electric welding process, which has been successfully applied in a number of difficult cases where reliability and uniformity of metallic structure at the joint were necessary. The peculiarity of the system is in the use of a special metal electrode, which, among other things, enables the composition of the welding material to be predetermined, and allows of successful welding from the underside. A demonstration of the genuineness of the weld, by means of a hammer and chisel, was convincing; we hope to return to the subject in more detail in our next issue.

National Insurance Bill.—In last Friday's Parliamentary Papers, Mr. Rendall asked the Chancellor of the Exchequer whether any proposal in the Insurance Bill would be the means of relieving any employer from payment of compensation to his employés under the Workmen's Compensation Acts or the Employers' Liability Act; whether the Insurance Bill provided that a workman should not receive both compensation under these Acts, and sickness benefit at the same time; and whether any expression of opinion on the result of this provision had been made by the actuaries advising either friendly societies or trade unions.—Mr. M'Kinnon Wood said that the Insurance Bill did not relieve employers from any liability under the Workmen's Compensation Acts or the Employers' Liability Act: neither did it prohibit a workman from receiving both compensation from his employer, and sickness benefit from his society, if he had contracted to pay for it. It did prohibit a workman from receiving benefit in return for his contribution under the Bill in cases of accident where the amount of the compensation was more than the benefit. That prohibition was inserted in accordance with the advice of the eminent actuaries employed by the Government, and their advice had been endorsed by actuaries advising both trade unions and friendly societies, and by very many competent persons, and it was in accordance with the principles of equality upon which the Bill proceeded, for it would be unjust, when all trades paid the same contribution, to pay a greater benefit to those trades in which accidents were most frequent.

Electrical Contractors' Association (East Yorkshire).—The inaugural dinner of the above branch of the Contractors' Association was held at the Grosvenor Hotel, Hull, on Saturday evening, Councillor W. L. Harrison, the president, being in the chair.

Mr. E. M. Parson, a well-known Hull electrical contractor, in proposing "The Mayor and Corporation," said, as electrical contractors, they ought to congratulate themselves that their municipal relations were not the same as in Sheffield and other towns, which absolutely drove the contractor out of the field by doing all the work themselves. They had every reason to be grateful for the way the Corporation Electric Lighting Committee treated the contracting firms. The speaker referred to the progressive attitude of the Corporation, and added that, as electrical contractors, they were looking forward to the time when there would be some very fine wiring jobs to do in Hessle, Cottingham and district. Ald. Hanger, chairman of the Corporation Electricity Committee, in reply, stated that during the time he had been on the Council they had always spent money wisely. They had spent £90,000 to purchase the old gas company, and reduced the price of gas to consumers in the old part of the town. On telephones they had spent £60,000. On the electrical undertaking they had expended £400,000, and were projecting a big scheme of extension.

Mr. H. Hyde, in speaking of the trade of Hull, said they could congratulate themselves that the electrical trade was in a fairly flourishing condition, and he was hoping that when the Corporation had got the new plant about which there had been so much talk, they would see their way to reduce prices. They were decidedly discouraged in persuading anyone to take up electricity for heating or cooking at the present rates. He advocated the holding of an electrical exhibition.

Mr. H. Bell, the city electrical engineer, in the course of his speech, favoured an examination for members of the Association, as in the case of plumbers. Electricity, he said, was going to play a very much more important part than in the past in the industrial and domestic economy of the country.

National Telephone Co.'s Staff Dinner.—On Saturday last, the Midland province of the National Telephone Co. held a staff dinner at the Grand Hotel, Birmingham, prior to transfer to the Post Office, and to bid farewell to Mr. Alfred Coleman, superintendent of the province since its inauguration. The chair was taken by Mr. John Scott, assistant provincial superintendent, and there was an attendance of upwards of 400 members of the staff of the Midland province and guests from London and elsewhere. Mr. and Mrs. A. Coleman were the guests of the evening, and others present included Mr. S. J. Goddard, general superintendent, London; Mr. F. Gill, engineer-in-chief to the company; Mr. W. E. Hart, solicitor; Mr. E. J. Eldridge, superintending engineer to the Post Office; Mr. C. B. Clay, metropolitan superintendent; Mr. F. J. Watson, superintendent, Scotland; Mr. W. W. Cook, assistant engineer-in-chief, London; and Mr. R. Shepherd, superintendent, North-Western province.

The loyal toasts having been honoured, the chairman spoke briefly, in view of the long programme in front of him, of the long association of Mr. Coleman with the Midland province, and the affection and esteem in which he was held by all who had come under his influence during this period.

Mr. Williamson, test manager, Birmingham, proposed "The Company," and referred briefly to its history and development. In responding, Mr. Goddard gave expression to his pleasure in being present, and spoke appreciatively of his long association with Mr. Coleman. Looking back, he said that there had been faults in the service, but that it was now satisfactory to the public and themselves. In the beginning, members of the public had had pluck enough to put money into the concern, although the Government regarded the innovation somewhat as a toy. Their success as a company had been due to the loyalty and devotion of the members of the staff of all grades. Looking ahead, he thought that 10 years hence, as servants of the National Telephone Co., they would have nothing to be ashamed of. Personally, he had more confidence in private than in Government administration.

The toast "The Head Officers of the Company" was put by Mr. Ruddock, district manager, Hanley. Mr. F. Gill, in responding, spoke of the encouragement he had received as a young man from Mr. Coleman, and referred to the great and noble traditions of the National Telephone Co., which, if lived up to, would ensure their future success.

Mr. Bennett, district manager, Sheffield, on behalf of the members of the staff of the Midland province, then presented a gold watch to Mr. Coleman, and a necklet and brooch to Mrs. Coleman. He spoke of the cheerfulness and upright character of Mr. Coleman, which had gained for him the esteem of every member of the staff.

Mr. Coleman, after acknowledging the kindness of the staff, spoke first of early difficulties in the matter of convincing people that they needed telephones, and secondly, of their difficulties in getting wayleaves. From a shareholder's point of view they were a well-managed company; their success was not due to the directors and management only, but to the enthusiasm of all members of the staff. He urged all present not to succumb to the sometimes petrifying influence of red tape, but to keep alive in their work.

An excellent programme of music was arranged, and the items were interspersed with the speeches, including a song "Farewell N.T.C.," written for the occasion and sung by Mr. Lewis.

Institution and Lecture Notes.—Institution of Electrical Engineers (Birmingham Local Section).—Last Friday the fifth annual dinner of the Birmingham Local Section was held at the Grand Hotel, Birmingham, and was attended by upwards of 100 members and guests. The chairman, Mr. Railing, occupied the chair. The guests included the President of the Institution (Mr. S. Z. de Ferranti), Dr. Gisbert Kapp, Mr. W. H. Patchell, Mr. Robert Hammond, and Messrs. J. E. Kingsbury, R. K. Morcom, H. Hirst, T. Harding Churton, W. Judd, W. W. Cook, H. Faraday Proctor and P. F. Rowell (Secretary), representing the Council of the Institution.

The Chairman, having put the loyal toasts, proposed "The Institution of Electrical Engineers." Having thanked the members for again electing him chairman for the new session, Mr. Railing introduced the subject which he thought was uppermost in the minds of everyone, viz., the new Articles of Association. He expressed the belief that the Council of the Institution was only too ready to acknowledge the rights of all corporate members, and to allow them full opportunity for expression of their views. After referring to the increasing importance of the Birmingham district, he urged members to take a broad view of the situation, and to support the Council in their efforts to increase the scope and usefulness of the Institution, which was the main object of the new Articles. Mr. Ferranti, in responding, with reference to the new Articles, explained that the giving of the legal notice only was purely formal; he was pleased that so much interest had been awakened, and if it could be maintained the Institution would prosper and extend its usefulness. He felt that the country as a whole did not realise the importance of the electrical engineering industry, and that stronger Parliamentary representation was desirable. This deficiency would be corrected by including in the membership men of standing, not necessarily technical men, and with this in view, the Council was proposing to rechristen the Associate class, and also providing a new class for the people thus excluded from the Associates. Concluding, he rather welcomed the accident in procedure, as it had awakened contentious elements which must finally tend to the benefit of the Institution and he urged members to regard the new proposals unselfishly and in a broad light.

Mr. W. H. Patchell, vice-president, in proposing the "Birmingham Local Section," congratulated the city on its recent development, and strongly advocated the election of trained engineers as members of Parliament. Mr. A. M. Taylor, vice-chairman, in responding, appealed to every member to do his duty and make the necessary personal sacrifice that the requirements of the Institution demanded.

Mr. R. A. Chattock, past-chairman, proposed "Electrical Industries and Our Guests." He referred to the rapid advance in the application of electricity as shown by the recent Electrical Exhibition, and advocated the hiring-out of apparatus to popularise the developments taking place. Referring to the reorganisation of the Electrical Manufacturers' Association, Mr. Chattock strongly supported the avoidance of cut-throat competition, which resulted in economies in manufacture that were fatal to reliability and adversely affected continuity of service. Mr. Robert Hammond, in

responding, asked members to regard the Council as their own Council, and not as the London Council. In reference to the electrical industries, he drew attention to the fact that electrical engineers depended upon the development of electrical industries, so he thought that the Institution should do all in its power to develop, not only the profession of electrical engineering, but the electrical industries themselves. Mr. J. E. Kingsbury, in responding, expressed the proudest hopes for the electrical industries.

Mr. M. Solomon proposed "The Chairman," who made a suitable response.

Mr. W. E. Warrilow, Mr. J. P. Kemp, Mr. G. C. Vyle, Mr. H. E. Wasser, and the G.E.C. Orchestral Band contributed in a large measure to the evening's enjoyment by performing musical and humorous items.

Physical Society of London.—At the meeting on October 27th, a paper on "Further Observations on the Afterglow of Electric Discharge and Kindred Phenomena" was read by the Hon. R. J. Strutt, F.R.S. It was shown that ozone prepared by means of the Siemens ozone tube used at atmospheric pressure was able, when mixed with nitric oxide, to give the greenish-yellow afterglow flame. A blue glow was obtained under the same conditions with sulphuretted hydrogen and ozone. The effect of sulphur compounds in improving the air glow was shown to be due to their power of destroying organic matter prejudicial to ozone. Pure oxygen does not give an afterglow. A paper on "Homogeneous Fluorescent X-Radiation of a Second Series," by Prof. C. G. Barkla and J. Nicol, was read by Prof. Barkla.

Association of Engineers-in-Charge.—On December 13th, a paper is to be read on "Methods of Dealing with Losses in Steam Plant due to Condensation," by Messrs. Geo. Wilkinson and J. Rendell Wilkinson. Mr. Frank Bailey will preside.

Mr. W. W. Lackie, chief engineer of the electricity department of the Glasgow Corporation, recently delivered a lecture under the auspices of the Glasgow Health Culture Society, on the subject of "Electrical Energy and its Relation to the Smoke Problem."

Northampton Institute Engineering Society.—A paper on "Diesel Engines" was read before the Society on Friday, November 3rd, by Messrs. T. R. Houston and F. G. Parnell.

Crystal Palace Old Students' Society.—The seventeenth annual dinner of the Old Students of the Crystal Palace School of Practical Engineering was held at the Criterion Restaurant on November 9th. Mr. Sidney R. Lowcock represented the president, Mr. Diogo A. Symons, who was abroad. Sir Fortescue Flannery, in proposing the toast of "The Engineering School," dwelt upon the advantages of theoretical training combined with practical work. Mr. Maurice Fitzmaurice, chief engineer of the L.C.C., proposed the toast of "The Old Students' Society," and Mr. Elliott Cooper, vice-president of the Institution of Civil Engineers, responded for "The Visitors." The Crystal Palace Old Students now number considerably over 2,000, and it was pointed out that during the past year the record showed that between 80 and 90 appointments, some of them being leading positions, had been gained by Old Students. A very large proportion of the members of the Society are engaged upon works abroad and in the Colonies, and many of the older members hold positions of the first importance.

Iron and Steel Institute.—The Council has unanimously elected Mr. Arthur Cooper, of Middlesbrough, to succeed the Duke of Devonshire in the Presidency of the Institute next May.

Society of Engineers (Incorporated).—On November 6th a paper on "Two-Cycle Engines" was read by Mr. R. W. A. Brewer. The author described in detail the tests carried out on a Lamplough two-cycle engine, showing the effects of the various adjustments and alterations made as the tests proceeded, and the interesting results obtained. He referred to the great possibilities of this type of engine, but admitted that very much remained to be done before it could hope to displace the four-cycle engine.

Manchester Association of Engineers.—At a meeting on Friday last, Mr. E. O'Brien, of Horwich, delivered an address on the electrification of railways. He gave an instance of the dispatch on an electrified system of the L. & Y. Co., where an electric train discharged 1,000 passengers, the time between arrival and departure being 90 seconds. For suburban traffic with short distances between the stations electric traction was indispensable when a very fast schedule with many stops was contemplated; such a service could not be run by steam trains. For ordinary services such as were run by steam trains to-day—the slow schedule with many stops—the actual running of the trains was probably more economical with electricity. The electric railway of the future, said Mr. O'Brien, appeared to be a continuous current third-rail system for suburban and inter-suburban lines, with possible stretches of straightforward main line on the single-phase system, which would preclude the movement of the suburban motor coaches or shunt engines from one district to another. The goods yard would only have the entrance electrified, and would be worked largely by separate battery locomotives. Only by this means could the prohibitive cost of the overhead construction or the unnecessary use of the third rail and the comparatively useless electrification of sidings only used occasionally by a locomotive be avoided.

Nobel Prizes.—The Swedish Academy of Science has awarded the Nobel Prize for Chemistry to Mme. Curie, of Paris, who, with her husband, discovered radium. Prof. Wilhelm Wien, of Würzburg, receives the prize for physics. The value of each prize this year is £7,773.

Wiremen's Wages Advance.—A correspondent states that the Electrical Contractors' Association has agreed to increase the wages of electrical wiremen employed in the building trades in the Manchester district by a halfpenny per hour. The advance takes effect from to-morrow (Saturday).

Manchester Smoke Abatement Exhibition.—The Manchester and Salford Smoke Abatement Exhibition was opened on Friday, November 10th, by the Lord Mayor of Manchester, and promises to be a great success. The Exhibition has been organised by the Manchester and District Smoke Abatement Society and by the chairmen of the Gas, Electrical and Sanitary Committees of the Manchester and Salford Corporations. As indicated by the support which is being extended to the Exhibition, its scope is very extensive, and exhibits of gas and electrical appliances for lighting, heating, cooking and ventilating form the chief features of the first two sections. The third section deals with the prevention of factory smoke, and in this section are to be found exhibits of various forms of mechanical stoker and other apparatus for reducing or preventing the emission of smoke from factory chimneys.

The division of the Exhibition into three sections, and the important position assigned to gas and electrical apparatus, proves that the promoters regard the problem of domestic smoke in the United Kingdom as of equal importance to that of factory smoke; and in this view they will be supported by all those who have made a close study of the smoke problem. In foreign countries the domestic smoke problem does not exist, for the closed stove, burning some form of smokeless fuel, is in general use. In the United Kingdom the general adoption of the unscientific form of open fire grate, in which the cheapest form of bituminous coal is burned, greatly intensifies the black smoke problem in all large cities, and the educational influence of the recent exhibition at Glasgow, and that opened on Friday at Manchester, cannot be over-estimated. Both exhibitions are likely to be of great service in reducing the smoke emitted from domestic chimneys.

The Mayor of Manchester, who opened the exhibition, stated that many large factories, which were formerly operated by coal, were now working with electricity or gas, and in certain cases gas was being utilised for the generation of electricity. The extension of such methods would make for the benefit of everybody concerned. He was glad to say that the Manchester Corporation had taken an enlightened view with regard to the supply of electricity for power purposes, and gave a supply at prices which were low and would compete with coal.

Miss Margaret Ashton (Manchester's first and only lady councillor), in supporting a vote of thanks to the Mayor, stated that there was room for great improvement in the use of gas for domestic purposes, and that she was trying to find a method whereby the family washing might be done with less discomfort.

The exhibition is to remain open for two weeks, and on November 21st and 22nd a Smoke Conference is to be held in connection with the annual meeting of the Smoke Abatement League of Great Britain. The programme of this Conference, so far as at present arranged, is as follows:—

Tuesday, November 21st, 3 *to* 5 *p.m.*—It is hoped that the Lord Mayor will preside at this sitting. Mr. A. Gordon C. Harvey, M.P., will deliver the Presidential Address. Mr. John W. Graham will explain the Bill, which is to be promoted by the League. Mr. Ernest D. Simon will speak on the aims and policy of the League. Dr. Des Voeux, of London, will read a paper.

6.15 *p.m.*—Annual business meeting of the League.

6.30 *p.m.*—Lectures illustrated by lantern slides:—

1. Short lecture by Prof. Cohen, Ph.D., B.Sc., of Leeds University, on "Soot, its Quantity, Nature and Effects."

2. Short lecture by A. Ruston, B.A., B.Sc., of Leeds University on the "Effects of Smoke on Vegetation."

The above will be followed by discussion. These papers embody the results of important recent research, as yet unpublished.

Wednesday, November 22nd, 10 *a.m.*—The engineering and technical side of the subject will be treated. Mr. G. B. Storie, M.I.M.E., of Rochdale, will read a paper on the "Effect of Smoke on Boiler Plant Efficiency," and Mr. James Bibby, engineer to Messrs. Bibby & Co., of Liverpool, will follow with a paper on a similar subject.

Councillor W. B. Smith, of Glasgow, will read a paper on "Domestic Smoke," and Mr. Peter Fyfe, Chief Health Inspector of Glasgow, one on "Air Pollution in Scotland."

In a later issue we hope to give a brief report of the above papers and discussions, together with some account of the exhibits that are likely to be of special interest to our readers.

Electro-Harmonic Society.—The next concert of this Society (ladies' night) will be held at the Holborn Restaurant (King's Hall) on Monday evening, November 20th, at 8 o'clock. Mr. W. J. Tennant, M.I.Mech.E., Fel.C.I.P.A., will be the chairman, and the programme, in brief, is as under:—Vocalists, Madame Edith Hands (soprano), Miss Mabel Braine (contralto), Signor Lenghi (tenor), Mr. Jackson Potter (bass-baritone); solo pianoforte, Miss Edith Gunthorpe; solo concertina, Miss Christine Hawkes; musical sketches, Miss Dorothy Varick; humorous sketch, Mr. Barclay Gammon; ventriloquist, Mr. Sidney Gandy; accompanist, Mr. Bernard Flanders, A.R.C.M.

Appointments Vacant.—Switchboard attendant for the Haslingden Corporation electricity department (15s.); switchboard attendant for the Erith Council electricity and tramways department (20s. to 25s.). See our advertisement pages to-day.

Inquiries.—Correspondents ask for the "Yasco" electric daylight lamp, of 200 c.p., and the names of the makers of electric beer-raising engines with automatic switches.

Royal Society Medal.—The Hughes Medal has been awarded to Mr. C. T. R. Wilson, F.R.S., for his investigations on the formation of cloud and their application to the study of electrical ions.

Change of Address.—Messrs. Siemens Bros. & Co., Ltd., announce that from November 20th the greater part of their office staff is being removed from Caxton House, S.W., to the Woolwich Works. Communications should be addressed to Woolwich for the following branches of the business: Insulated wires and cables; telegraph and telephone apparatus; line materials; measuring and testing apparatus; batteries; railway signalling; publications; accounts.

Water-Power Legislation in Switzerland.—A report on a Bill to regulate the use of water-power on Confederation lines in Switzerland has just been submitted to the Department for the Interior. The report states that the Confederation has a positive interest in seeing that the power obtained from waterfalls is rendered available to the general community—that is to say, that it is not made excessively dear for Cantonal or speculative reasons, and for this purpose the Bill restricts the charge per horse-power to a definite sum except for certain undertakings. The grant of concessions and the fixing of conditions in individual cases devolve upon the Cantons according to the Swiss Constitution, and the Cantons will therefore settle the dues and taxes which the hydro-electric works have to pay. The Confederation is empowered to place limits upon this burden, but the greatest difficulties are met with in doing so. Nevertheless, the Bill has endeavoured to restrict, as already mentioned, the charging of high prices for the energy obtained from water-power. In the case of inter-Cantonal waters, the duty devolves upon the Confederation to decide as to their utilisation in the event of the Cantons failing to reach an agreement, and in cases where waters are of an international character the Federal Council is to intervene and conduct negotiations with the country concerned, and to give approval to agreements before being concluded. The Bill also deals with the problem as to what demands the Confederation can put forward for water-powers which are required for its own purposes, as for the working of the railways. It is therefore provided that the Confederation shall have the right of disposition in regard to such water-powers, and shall not be dependent upon the goodwill of Cantons, districts or communes.

Detecting Leaks in Vacuum Apparatus. — In a letter to *Nature* of the 9th inst., Mr. F. W. Aston, of the Cavendish Laboratory, Cambridge, says he has for many years successfully localised leaks in "all-glass" apparatus with Goldstein's method, by disconnecting the kathode lead, putting in a small alternate spark-gap, and exploring over the suspected joints with the loose lead; the position of the leak is indicated by a brilliant discharge to the inside of the apparatus.

In the case of sealing-wax joints an excellent method is to wipe each joint over with a small pad of cotton-wool soaked in petrol, while the discharge is kept going; when the faulty joint is reached, the discharge suddenly changes colour. The test is extremely delicate, and is suitable for all air leaks provided that they are not so bad as to prevent the discharge from taking place.

The Melting Point and Temperature Coefficient of Tantalum.—An article in the *Zeitschrift für Elektrochemie* of October 15th gives the results of a research by M. von Pirani and Alfred R. Meyer on this subject. One of the authors had previously attempted to estimate the melting point of tantalum, but the errors introduced into the method seemed to show that too low a value (2,900° C.) had been ascribed to the melting point. The measurements now described refer to the Holborn-Valentiner scale of 1907 and the constant of Wien's law $C = 14{,}200$, and assume the melting point of gold to be 1,064° C. and of palladium 1,575° C. The melting point was determined in the present experiments by the two following methods:—

First of all a loop formed of a strip of tantalum 0·99 mm. wide, 0·041 mm. thick and 100 mm. long was suspended in an evacuated glass vessel, the relation between the current and voltage of this strip lamp, also its black-body temperature to 2,000° C., being determined. The current was then steadily increased until the strip melted through, the temperature, current and voltage being observed at the moment of fusion. The temperature observations had at the lower values to be corrected for the amount of absorption by the glass globe; and, for the observation of the melting point, for the amount absorbed by the *blackened* glass globe.

A further factor to be considered was that tantalum was not a black body, and that by reason of the reflective power of tantalum (44 per cent. for the wave-length under consideration, at which the observations were made), a correction had to be applied.

In addition to the method of observation described above, the connection between the intensity of total radiation and temperature (Stefan's law) was used. The total radiation was indicated in watts in the loop lamp, since current and voltage are observed direct, and the loop (suspended in a high vacuum), gave out again in the form of emissive energy nearly the whole of the energy sent into it.

The experiments for determining the melting point with strips might probably give a result which would be somewhat too low, since the strip may fracture in consequence of its own weight shortly before the melting point is attained. In order to obviate this danger the melting point was also determined by another method. A tantalum wire of about 1 mm. thickness was used as an anode in a mercury arc lamp, and the end of this wire fused by increasing the current. At the moment of fusion measurements could be taken on the small fusion bulb formed, this bulb adhering, by reason of its surface tension, to the wire until it had attained a size of 1 to 2 mm. diameter. The moment at which fusion occurred was very accurately characterised by small movements and deformations of the bulb in consequence of the blowing action of the arc. The current-consumption at the moment of fusing was approximately 10 to 15 amperes.

In all, 14 observations of the melting point were made by the methods indicated; the mean value 2,850° C. being obtained with an accuracy of ± 40° C. From this it is seen that the measurements carried out in the research mentioned above gave nearly the correct value, but that the sources of error of measurement were greatly over-estimated. The observations of current, pressure and temperature made on the strip-loop lamps enabled the experimenters to carry the resistance curve of tantalum considerably farther than previously, to within the neighbourhood of the melting point of platinum.

Duty on Catalogues for Australia.—The following interesting paragraph on this subject recently appeared in an Australian newspaper:—"The abolition of the duty on illustrated trade catalogues, we learn from Melbourne, was requested by a deputation of 20 importers, representing 100 British houses and the English Manufacturers' Association, introduced to the Minister of Customs on Thursday by Mr. H. Wickes, British trade representative. In putting the case, Mr. P. Rosling, president of the Institute of Electrical Engineers, urged that numbers of catalogues were really text-books of advantage to engineers in Australia. The duty prevented their circulation, and brought no work to Australia, for out of, say, 1,000 expensive catalogues printed in Britain, perhaps only 50 would be sent to the Commonwealth. The duty of 6d. a lb., or 35 per cent., meant that firms did not accept delivery of goods, and the post offices were burdened with the work of their return, or they were destroyed. In reply, the Minister stated aspects of the question had not been touched upon by the deputation. A British firm starting to manufacture in Australia would consider itself penalised if duty had to be paid on their catalogues. Before giving his answer Mr. Tudor will consult printing houses, and discover how much work the duty brings to them."

Electrical Heating of Houses.—During the coming winter the Gothenburg Electrical Works intend to start practical experiments on a large scale upon the heating of houses by means of electricity. As a commencement, electrical heating apparatus will be installed in two five-storey houses. The chief object of these experiments is to employ the energy available during the night-time, when only a fraction of the output is used for industrial purposes; it is easy to see what a great advantage it would be to employ the whole amount of available energy constantly, especially when it is derived from waterfalls and not from coal. The cost of producing the energy does not amount to more than $\frac{1}{10}$d. per KW.-hour, and it is therefore estimated that the works should do an excellent business by disposing of it for the above-mentioned purpose at a price of $\frac{1}{2}$d. per KW.-hour, which would be an exceedingly cheap price to householders.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. S. H. DANIELS has resigned his position as shift engineer at the West Bromwich Corporation electricity works, in order so take up the position of shift engineer in the power station at the works of Messrs. Cammell, Laird & Co., Ltd., Sheffield.

General.—At the Newton Abbot electricity works on Friday, November 3rd, MR. A. J. JENKINS, the late clerk, who has taken up a better position at Cromer electricity works, was presented with an engraved silver cigarette case, presented by the staff and employés of the Urban Electric Supply Co., Ltd. The resident engineer, Mr. G. E. Smith, voiced the sentiments of the donors in making the presentation.

Our Durban correspondent reports that MR. F. W. MILLS, electrical engineer of the late Natal Government Railways and Harbour, has been appointed chief electrical engineer of the railways and harbours of the Union of South Africa, with headquarters at Johannesburg. He also reports that MR. J. DENHAM, electrical engineer of the late Cape Government Railways, has been appointed electrical adviser of the Mines Department of the Union of South Africa.

MR. GEORGE RALPH, who for the past 13 years has been works manager at Messrs. J. H. Holmes & Co.'s electrical works, Newcastle-on-Tyne, and who is about to take over a responsible position with the Electric and Ordnance Accessories Co., Ltd., Birmingham, has been made the recipient of a handsome gift from his former colleagues at a smoking concert recently held. The gift, which consisted of a lathe, set of tools and accessories, were handed over by Mr. T. Carter on behalf of the donors, and a pendant was also presented to Mrs. Ralph. Mr. J. Walker presided.

MR. SHERARD COWPER-COLES has now started private laboratories at 1 and 2, Old Pye Street, Westminster, which are being fitted up especially for electrochemical and metallurgical work, the equipment including an electric furnace, for which a 100-H.P. transformer is being installed.

We understand that Mr. C. C. F. Monckton is giving up his consulting practice at Parliament Mansions, Victoria Street, S.W., to take up the newly established post of Superintendent of Telegraphs and Telephones, Fiji, and that he leaves England on November 15th. His business will be carried on by Mr. Arnold G. Hansard, of the same address, in conjunction with whom he has worked for the last five years.

Mr. H. E. Potts, of the technical staff of the British Insulated and Helsby Cables, Ltd., Prescot, who is leaving to take up a position in London, has been presented by his colleagues with a walking stick and umbrella.

Bailie W. F. Russell and Bailie Walter Nelson have been re-appointed convener and sub-convener of the Glasgow Tramways Committee, and Mr. James Willock and Bailie W. B. Smith have been elected respectively convener and sub-convener of the Electricity Committee.

Indian Engineering says that during the absence of Mr. G. B. Winter on long leave home, Mr. A. H. Smyth, his assistant, acts as electrical and signal engineer, South Indian Railway.

Messrs. Lacey & Sillar, consulting engineers, Manchester, have been retained by the Lancashire Territorial Association.

NEW COMPANIES REGISTERED.

Melksham Electricity Supply Co., Ltd. (118,263).—This company was registered on October 27th, with a capital of £2,000 in £1 shares (1,000 preference), to carry on the business of an electric lighting and power company in all its branches. The subscribers (with one share each) are:—J. H. Edwards, 127, Victoria Street, Bristol, engineer; E. L. Watts, 38, Parliament Street, Westminster, solicitor. Private company. J. H. Edwards is the first managing director. Registered by Seymour, Williams & Co., 38, Parliament Street, S.W.

Tramways Third Party Assurance, Ltd. (118,326).—This company was registered on October 31st, with a capital of £10,000 in £1 shares, to carry on the business of fire re-insurance, insurance against accidents connected with electric or other tramways, light railways, motors and vehicles, &c. The subscribers (with one share each) are:—R. H. H. Eden, Temple Cowley, Oxford, land agent; J. Whittle, 12, Queen's Road, St. Anne's-on-Sea; A. W. Johanning, Fairholme, Strawberry Hill, director; H. Bendy, 47, Milton Street, E.C., director; A. L. Sherwood, 46, Hamilton Gardens, N.W., publisher; R. A. Bendy, Fermain, Hampton, traveller; A. B. Johanning, 36, Gracechurch Street, E.C., merchant. Minimum cash subscription, whole capital. Registered without articles of association. Registered by Jordan and Sons, Ltd., 116-17, Chancery Lane, W.C.

Manorhamilton and District Electric Light Co., Ltd. (3,741).—This company was registered in Dublin on November 1st, with a capital of £1,000 in £1 shares, to acquire and carry on the business of electricians, mechanical engineers, manufacturers, workers and dealers in electricity, motive power and light, now carried on at Manorhamilton, Co. Leitrim, as Wm. Breakey Hamilton. The subscribers (with 20 ordinary shares each) are:—D. Walsh, Manorhamilton, Co. Leitrim, merchant; J. McGuinness, Manorhamilton, Co. Leitrim, merchant; J. Lynott, Manorhamilton, Co. Leitrim, merchant; Dr. R. A. Rutherford, Earlsfield, Manorhamilton, Co. Leitrim: A. A. Alges, Edenville, Manorhamilton, Co. Leitrim, retired merchant; G. W. Ballman, Manorhamilton, Co. Leitrim, merchant; J. N. Dolan, Manorhamilton, Co. Leitrim, merchant; J. McGovern, Manorhamilton, Co. Leitrim, hotel proprietor; J. Rooney, Manorhamilton, Co. Leitrim, merchant; C. M. Templeman, Manorhamilton, Co. Leitrim, auctioneer. The first directors are D. Walsh, J. McGuinness, J. Lynott, R. A. Rutherford, A. A. Alges, G. W. Ballman, J. McGovern, J. N. Dolan, J. Rooney and C. M. Templeman. Offices, The Commercial House, Manorhamilton, Co. Leitrim.

Universal Cheap Cables, Ltd. (118,401).—This company was registered on November 3rd, with a capital of £100,000, in £1 shares, to carry on the business of wireless and other telegraphists and telephonists, so far as they lawfully can, manufacturers and constructors of telegraph lines, instruments, machinery, wire and materials, to acquire the patents and rights of the Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd., for transmitting printed and typewritten telegraph messages by wireless telegraphy and over cables and land lines, and for receiving them directly printed at receiving stations, &c. The subscribers (with one share each) are:—O. H. Walker, 131, Finborough Road, Earl's Court, S.W., managing clerk; J. Day, 76, Bramfield Road, New Wandsworth, clerk; W. D. Bowles, 13, John Street, Bedford Row, W.C., managing clerk; F. R. Cooper, 10, Granville Road, Wandsworth (secretary Royal Oak Benefit Society); A. Angold, Meadow View, New Barnet, surveyor; W. C. Woodford, 20, Southcote Road, Tufnell Park, N., clerk; G. Wallington, 15, Great James Street, Bedford Row, W.C., solicitor. Minimum cash subscription, £100. The number of directors is not to be less than two or more than seven; the first are W. Hohner, Wurtemberg; W. F. C. Michaelis, 65-6, Basinghall Street, E.C.; A. T. M. Johnson, 77, Shepherd's Bush Road, W.; and F. G. Lloyd, 40, King Street, Cheapside, E.C. Qualification, one ordinary share. Remuneration (except managing director), £300 per annum, divisible. Registered office: 40, King Street, Cheapside, E.C.

Economic Packing Co., Ltd. (8,047).—This company was registered in Edinburgh on November 7th, with a capital of £5,000, in 4,500 cumulative preference shares of £1 each, and 10,000 ordinary shares of 1s. each, to acquire inventions and patent rights of A. A. Brown, Rutherglen, relating to boxes and packages for carrying electric lamps, incandescent gas mantles, &c. The subscribers (with one share each), are:—A. Glen, Lismore, Carmyle, valuator; M. Steel, Woodside, High Crosshill, Rutherglen, manager. Private company. The number of directors is not to be less than three or more than five. The first are A. A. Brown, A. Glen and M. Steel. Qualification, £50. Remuneration of A. A. Brown, as manager, £200 per annum: of other directors, not stated. Registered office: 65, Bath Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—Return dated August 29th, filed September 28th, 1911; capital £30,000 in £10 shares; 2,041 shares taken up; £5 per share called up on 1,195 and £10 per share on 260; £8,475 paid; £5,960 considered as paid on 96 shares. Mortgages and charges: £3,176 13s. 8d.

Exchange Telegraph Co., Ltd. (6,152c).—Return dated August 10th, filed August 18th, 1911. Capital £246,950 in £10 shares (8,125 "A" and 16,500 "B"); 8,023 "A" and 16,200 "B" shares taken up; £9 per share called up on 6,000 "A" and £1 per share on 2,023 "A"; £56,023 paid; £179,000 considered as paid, being £10 per share on 16,200 "B" and £8 per share on 2,125 "A"; £816 considered as paid on 102 forfeited shares. Mortgages and charges: £5,000.

Consolidated Electrical Co., Ltd. (77,054).—Return dated August 10th, 1911. Capital, £125,000 in £1 shares (15,000 preference). Al shares taken up. £1 per share called up on 15,100 preference and 757 ordinary and 5s. per share on 109,243 ordinary. £43,067 15s. paid. £81,932 5s. considered as paid on 109,243 ordinary. Mortgages and charges: Nil.

Campbell & Isherwood, Ltd.—Equitable mortgage on certain land with messuages thereon in Raleigh Street, Bootle, dated October 13th, 1911, to secure all moneys due or to become due from company to Bank of Liverpool, Ltd., 7, Water Street, Liverpool.

Johnson & Phillips, Ltd. (84,968).—Particulars of £50,000 second debentures created October 25th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £30,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to so much of £175,000 debenture stock created in 1905 as may for the time being be outstanding. No trustees.

Watson, Foggo & Co., Ltd. (117,891).—Particulars of £1,000 debentures, created October 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd. (54,600).—Return dated September 15th, filed September 30th, 1911. Capital £25,000 in £5 shares (3,200 preferred and 1,800 deferred). All shares taken up; £5 per share called up on 3,100 preferred; £15,500 paid; £9,500 considered as paid on 100 preferred and 1,800 deferred. Mortgages and charges: £48,100 sealed; £400 debentures applied for and paid for, but not sealed.

Foreign and Colonial Lighting, Ltd. (99,020).—Charge on certain moneys, dated October 10th, 1911, to secure £305. Holder: A. B. Beckitt, Kenmore, Highlands, St. Leonards-on-Sea.

London Electric Treatment Co. (1911), Ltd. (117,852).—Particulars of £2,000 debentures, created October 14th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—Issue on October 26th of £332 5s. debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Amazon Telegraph Co., Ltd.

Mr. George Keith presided on Tuesday at the offices, 42, Broad Street, E.C., only the seventeenth ordinary general meeting of this company.

In moving the adoption of the report, the Chairman said the accounts showed a remarkable increase in the company's business for the year under review. The unprecedented rise in the price of rubber which took place in the first half of last year led to a great increase in the rubber trade and business generally on the Amazon in which the duplication of their main cables enabled the company to fully participate. There was also an exceptional increase in official and other traffic in connection with the political troubles which took place in Manaos during October last. Altogether it had been an exceptional year, which was not likely to recur. The traffic receipts showed an increase for the year of 46 per cent., and the total revenue, including subsidy and interest on the year's cash balance, came out at £118,525, or £31,963 more than it did in the previous year. In comparing the year's working expenditure, the expenses at stations showed an increase of £1,280, and those in London were £168 more, both of which increases were to be attributed to the larger traffic. The expenses attending maintenance of cables had also increased by £2,126, due principally to the changing of the route of the Manaos Amatary No. 2 cable, which now formed part of the new duplicate cable. This No. 2 cable was laid six years ago along the Carrera Furo and always suffered from landslips in the river's bank. It was therefore considered advisable, before joining it up to the new cable, to change its route to along the Antuz River, where it had since been quite free from interruptions. The repairs required to be done to the existing cables had also added considerably to the expense of maintenance. The Rio expenses were more, and some of the other items showed an increase, all due to the special circumstances of the year's business. Altogether, the working expenses amounted to £54,945, or £5,023 more than in the preceding year. As regarded the other charges £15,000 was provided for debenture interest, and £15,000 was carried to reserve account, as provided for when the new debentures were issued, by which their redemption was postponed for two years, and the money applied to reserve for the purpose of establishing a reserve fund for the renewal and maintenance of the cables. After clearing off the debit balance of £18,493 brought forward from last year's accounts, the directors were able to recommend a dividend of 4 per cent. and the carrying forward of £5,669 to next year's accounts. He congratulated the shareholders on the result of the year's business. They had been able to establish a reserve fund for the renewal and maintenance of cables and pay a dividend for the first time in the history of the company. It was now over 16 years since the undertaking was

initiated, and he thought the company deserved well of the Brazilian Government for the sacrifice the shareholders had made during all these years in order to establish reliable communication along the river Amazon, which had been of immense benefit to the Government and the public. It had been a work of great difficulty. The laying of the first cable was only just completed when it began to break up and disappear. All endeavours to recover and repair it proved futile, and the old cable in the main river had practically to be re-laid along the side banks and side waters, in many places again and again before the system was completely restored. Since then the communication had been well maintained, except during the periodical fall of the river from June to November, when the cable still continued to suffer from the force of the river, and especially from land slips in the banks. Happily the delay had now been successfully resumed by the duplication of the cable, which was completed in March last. The expenditure incurred thereon during the year was £28,244, and this had been charged to capital account. The total cost of the new cable, not including the section between Amatary and Manaos, which was laid in 1905, came out at £171,013. The exceptionally high price of the rubber used in its manufacture greatly increased the cost, but this had been more than returned to the company by the increased revenue due to the same cause. The whole of the work was most successfully carried out by their able manager, Mr. Nosworthy, and the staff of the *Viking*. As the greater part of the new cable had been laid in side waters too shallow for their present repairing steamer to enter they were having a small steamer built of very light draught, which they expected would be ready to proceed to the Amazon by the end of the year. As regarded the current year, business generally in the Amazon continued dull and stagnant owing to the low price of rubber, and up to the present the message earnings were much under what they were last year, but better than they were the year before that. The outcome of the present year now depended upon the activity of business generally during the coming rubber season which was about to commence, and he hoped if all went well they would be able to present a satisfactory report when they met again.

Mr. Ellice Clark seconded the motion, and the report was adopted without discussion.

The proceedings terminated with a vote of thanks to the board.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Anglo-Argentine Tramways Co.—Scrip, fully and partly paid, for a further issue of £1,500,000 5 per cent. debenture stock.

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co.).—£800,000 5 per cent. 40-year first mortgage bonds of £100 each (Nos. 1 to 8,000).

Tri-State Railway and Electric Co.—$668,000 first mortgage and collateral trust 50-year 6 per cent. gold bonds of $1,000 each.

And to allow the following securities to be quoted in the Official List :—

Buenos Aires Lacroze Tramways Co.—Further issue of £50,000 5 per cent. extension mortgage debentures.

Chiswick Electricity Supply Corporation.—£80,000 4½ per cent. first mortgage debenture stock (special application).

Westminster Electric Supply Corporation.—Further issue of 20,573 4½ per cent. cumulative preference shares of £5 each, fully paid, Nos. 191,380 to 211,952.

Castner-Kellner Alkali Co., Ltd.—The directors report for the year ended September 30th that the net profit, after allowing for expenditure in keeping up the works, plant and machinery, is £178,853, plus £14,159 brought forward, making £193,012. The directors recommend the appropriation of £32,500 to depreciation reserve, increasing that account to £290,000; £47,500 to the general reserve, increasing it to £130,000; £56,250 in payment of a final dividend of 12½ per cent., making (with the interim dividend) 20 per cent. for the year, leaving £14,222 to be carried forward.

R. & J. Dick, Ltd.—At the annual meeting held in Glasgow on the 10th inst., Mr. J. Parker Smith, who presided, regretted to report a year's working in which the profits had shrunk to a fraction of their usual amount. He explained the reasons which made the directors believe that the results of this year might be expected to be quite exceptional, and that the prospects of their belting industry, so much the largest and most important branch of their business, were those of a sound industrial concern. The reduction of profits in this particular year was very untoward. Happily the reasons were not far to seek, and were of a kind that had been felt by many of the great india-rubber companies as well. The prices of belting were a matter which was extremely difficult to alter, and he need hardly say that it was absolutely necessary that the quality should be maintained, whether the profit for the moment was great or small. The report was adopted.

Continental Notes.—La Société des Usines Electriques de la Lonza, of Basle, reports a net profit of £9,084 for the last financial year, reducing the loss shown in the profit and loss account to £40,288.

The General Electric Co. of Belgium, Ltd., is the title of a new concern which has just been registered in Brussels, with a capital of £8,000.

La Société Electro-Chimique de Brignoud is the name of a company which has just been formed at Brignoud, near Grenoble, France, with a capital of £10,000.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

Sir John Wolfe Barry presided over the seventy-sixth half-yearly meeting, held at Electra House, Finsbury Pavement, E.C., on Tuesday.

The Chairman, in moving the adoption of the report, said the gross receipts for the half-year amounted in round numbers to £329,000, against £344,000 for the corresponding period of 1910, showing a decrease of £15,000, which was not surprising, seeing that in the first half of last year there was an increase of £54,000, due, in a large measure, to the rubber boom which was then at its height. The reduction during the past half-year was almost entirely in the Straits region, where the principal rubber estates were situated, the other portions of their system showing increases. The working and other expenses amounted in round numbers to £151,000, against £152,000 for the corresponding period of 1910, showing a small decrease, due to maintenance of cables having cost about £5,000 less than in the corresponding period of 1910. This more than compensated for the increased expenditure in connection with higher foreign service and other allowances, which, as he explained at the last meeting, the directors had found it necessary to grant to the staff owing to the cost of living in the Straits region having so largely increased in recent years. The net profit for the half-year was roundly £149,000, and, after adding £27,000 brought forward from the previous half-year, there remained an available balance of £176,000. The usual quarterly interim dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, and £50,000 had been transferred to the general reserve fund, leaving a balance to be carried forward of £51,698. When addressing the shareholders a year ago, he referred to a proposal submitted by the British Postmaster-General to the various cable companies interested for the introduction of a reduced rate for deferred telegrams in plain language, and he explained that the associated companies had agreed to the proposal in principle, leaving the necessary details to be worked out. Since then the proposal had taken definite shape, and been considered by the various Governments concerned, and it was expected that the British Postmaster-General would soon be in a position to make an official announcement on the subject. They would doubtless have gathered from the newspaper references to the revolution in China that the Chinese telegraph service had been seriously affected by the disturbances. As a matter of fact, most of the landlines in the north of China had been, and were still, interrupted, and confusion was reported to prevail throughout the whole Chinese telegraph service. Their cables to the Treaty Ports, and the landlines worked by this company and the Great Northern Co. between Pekin, Tientsin and Taku continued to carry the International traffic, to the satisfaction of all parties. The situation had naturally been one of anxiety, not altogether free from danger in some places, to the staff, who were ably and zealously carrying out their duties under trying circumstances.

The Marquess of Tweeddale seconded the motion, which was carried without discussion.

A hearty vote of thanks to the board and staff concluded the proceedings.

Hurst, Nelson & Co., Ltd.—The directors report that for the year ended July 15th there was a profit on working of £13,715. After writing off £11,708 for depreciation on wagons, deducting income-tax, directors' fees, &c., and making adjustments, there remains a debit balance on profit and loss account of £3 6s. 11d. Nothing (says the *Financial News*) has been set aside for depreciation on machinery. The special reserve fund for the payment of the preference dividend was utilised to pay the last half-year's dividend on the preference shares, and the directors regret that the state of the accounts will not permit of any further dividend being paid at this time. The disappointing results are attributed to the severe competition and to the labour troubles with which the company had to contend. The outlook is described as more hopeful, and the directors state that they are looking forward to better results for the current year.

Marconi's Wireless Telegraph Co., Ltd.—Mr. G. Isaacs presided over an extraordinary general meeting of this company held at the office, Watergate House, Adelphi, W.C., on November 9th, when the resolution increasing the capital, which was passed at the extraordinary general meeting of the company, held on October 25th, was submitted for confirmation. The chairman formally moved the adoption of the resolution, and it was seconded by Major Flood Page, and carried.

Provincial Tramways Co., Ltd.—The directors have declared a final dividend of 10d. per share, making a total dividend of 1s. 6d. per share (7½ per cent.) for the year to September 30th. They have set aside £10,000 for reserve and depreciation and £500 towards writing off the expenses of the debenture issue. £3,354 is to be carried forward as compared with £2,832 last year.

Prospectus.—*South American Light and Power Co., Ltd.*—This company is offering until Saturday an issue of £150,000 5 per cent. first debentures, at 96 per cent.

Ferranti, Ltd.

Mr. A. W. Tait presided on Friday, at Winchester House, E.C., over a meeting of the first mortgage debenture-holders of the above company, for the purpose of considering a resolution to increase the borrowing powers of the company.

The Chairman moved a resolution consenting to the raising by the said company of the sum of £50,000, by the creation and issue of £50,000 additional first mortgage debenture stock, carrying interest at the rate of £5 per cent. per annum, and also sanctioning the modification of the rights of the holders of the said first mortgage debenture stock by the creation and issue of the said £50,000 additional first mortgage debenture stock. He said that a circular had been issued to the first mortgage debenture-holders informing them of the proposal to increase the first mortgage debentures from £100,000 to £150,000, and the ordinary shareholders at their meeting had agreed to such increase. The business of the company had made satisfactory progress during the last two years, and a comparison of the accounts to April 30th with those of five years ago would show that the increase in the assets, which was, of course, the security for the debenture stock holders, amounted to no less than £87,788. This was distributed over land and buildings, £3,900; plant and machinery, tools, &c., £26,500; expenditure on work in hand, £34,500; stock and stores, £3,000; and sundry debtors, £19,600. Even if they deducted from that the amount of the depreciation reserve which had been made, viz., £36,500, they would still have an increase of £51,000 in the value of the assets. That was, of course, apart from the further increase which would take place when the extra stock was issued, because the cash proceeds of that issue, after repaying the outstanding prior lien debentures, would be devoted as further working capital of the company. Further working capital was required not only in connection with the development of existing lines of manufacture, but also because of certain developments which were taking place. Their meter business had grown enormously in the last few years, and the switch and instrument departments had also shown a considerable growth. They had also gone in for cooking and heating apparatus, for which there was likely to be a very considerable demand. Increase of business naturally meant increase of accommodation and plant, although they hoped to keep that within as narrow a margin as they could. Still, there must be a certain amount of capital sunk in that connection, and they hoped by the increased capital to be able to competently develop those two lines as well as to further develop the existing departments of the company's business. He had received an intimation from a number of large debenture-holders that they thougt it would be advisable that a further increase should be made to the sinking fund requirements. At present a sum equal to 3 per cent. of the stock must be set aside each year for sinking fund, and this would mean, when the new stock was issued, setting aside £4,500. The suggestion was now made that this 3 per cent. should be augmented by placing half the surplus profits in each year to the sinking fund, but that the directors should be at liberty to carry to reserve from time to time such amount of surplus profits as they thought desirable, on condition that the reserve fund should be retained for the benefit of the company, and not divided amongst the shareholders. The board were prepared to agree to this condition, but he was advised by the solicitors that it was not competent to submit it as an amendment to the resolution, although it would come up in connection with the new trust deed. A further matter was that under the trust deed the company had to pay the sum provided to the trustees, and their only power was to redeem stock by annual drawings at the price set forth in the deed. It was thought it would be to the advantage of the company to have the power to purchase stock either in the market or by tender, and if the stockholders agreed it was intended to deal with that matter also in the new trust deed.

Mr. A. B. Anderson seconded the resolution, and it was agreed to without discussion.

German Electrical Companies.

The Gesellschaft fur Elecktrizitats Anlagen of Berlin, which owns electric supply works, and is financialy interested in other similar undertakings, reports that both classes experienced a favourable development in 1910-11, whilst the latter also yielded higher dividends. After placing £4,400 to the redemption and renewal fund, as contrasted with £4,800 in 1909-10, the accounts exhibit net profits of £32,000, as against £30,000 in the preceding year. It is intended to distribute 8 per cent. as compared with 7 per cent. in 1909-10.

The Elektrische Licht und Kraftanlagen Gesellschaft, of Berlin, which is purely an investment company, reports that the electric supply works in which an interest has been held for a long time past, made further satisfactory progress in 1910-11. Some of the less important securities were disposed of at a profit, whilst on the other hand, advantage was taken of the opportunity to acquire an interest in other undertakings. After deducting loan and other charges the accounts indicate net profits of £124,000, as compared with £103,000 in 1909-10. The sum of £9,900 has been placed to the reserve fund, as against £9,500 in the previous year, and the balance allows of the payment of 7 per cent. on ordinary share capital of £1,500,000, this contrasting with a similar rate on £937,000 in 1909-10.

The directors of the Elektrizitäts Gesellschaft vorm. Hermann Poge, of Chemnitz, state that the degree of employment in 1910-11 was so favourable that difficulty was experienced in completing the orders. As this exercised an unfavourable influence on the prime costs, and as the external organisation was being successfully extended, it had been decided to make a substantial increase in the works' plant. After allocating £7,700 to depreciation as against £7,400 in 1909-10, the accounts exhibit net profits of £11,000 as compared with £9,500 in the previous year. A dividend at the rate of 7 per cent. has been declared on a share capital of £125,000, the same rate as was paid on £100,000 in 1909-10. It was mentioned at the recent meeting that the value of the orders invoiced so far in the new financial year exceeded that in the corresponding period of 1910 by 30 per cent.

The report of the Deutsche Gasgluhlicht (Auer) Gesellschaft, of Berlin, which manufactures the Osram lamp as well as incandescent gas appliances, states that the gross profits amounted to £327,000 in 1910-11, as compared with £345,000 in the previous year. After making provision for depreciation, the accounts show net profits of £282,000, as against £311,000 in 1909-10. It is proposed to pay a dividend of 5 per cent. on the preference shares and 50 per cent. on the ordinary shares, being the same rate as in the preceding year. The question of quality was decisive in connection with the prevailing over-production of wire lamps, and the sale of Osram lamps had consequently further increased, whereas various makers had either collapsed or worked at a loss. This development would be more expressly manifested in the future owing to the recent reduction in prices. The favourable results for the year were attributed materially to the extension of the business in Osram lamps, which had made further progress in the first four months of the new financial year.

Swedish Telephone Companies.—A Stockholm correspondent of a Frankfort newspaper, in referring to the development of the Swedish telephone manufacturing industry during the present year, states that L. M. Ericsson & Co. extended the scope of activity in May by co-operating in the formation of the Société des Telephones, L. M. Ericsson, of Paris. The former has now established two new companies in Vienna and Buda-Pesth, which have taken over the firm of Deckert & Homalka, of Vienna, together with the branches in Brunn and Prague. The Ericsson Austrian Electricity Co. and the Ericsson Hungarian Electricity Co. are the titles of the two companies which will be controlled by the parent Swedish company, and in which both Austrian and Hungarian banks are also interested. The correspondent further states that the Swedish company has recently concluded contracts for the supply of a telephone exchange to Cape Town for 4,000 subscribers and one for Pretoria for 2,000 sets of apparatus, as well as a contract for the Rand mines. The telephone installation in this gold mining district will be underground, and in connection with the installation above ground. Roumania has become a large purchaser of telephones, and negotiations are proceeding with the Bulgarian Government with a view to the establishment of an exchange in Sofia. It is added that the manufacturing activity of the Swedish company and its branches has been brisker in the present year than for several years past.

Cordoba Light, Power and Traction Co., Ltd.—The directors report that the balance of profit to September 30th, 1911, after meeting all charges, is £19,954, plus £8,202 brought forward, making £28,156. Out of this they recommend a dividend at the rate of 4 per cent., less income-tax, on the shares, and that £9,220 be carried forward. Since the date of the last report, the company has acquired further shares of the Cordoba Light and Power Co., and now owns 97·95 per cent. of its share capital, together with the whole share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd. The accounts of both the Cordoba Light and Power Co. and the Cordoba (Argentine) Electric Tramway Construction Co., Ltd., are made up annually to March 31st. In respect of the year to March 31st last, a dividend amounting, after deduction of income-tax, to £1,883, was received on the shares of the Tramways Co., and is included in the account. The conversion of the tramways for electric traction has proceeded satisfactorily. At the end of September, 26½ miles of track had been converted, of which nearly 17 miles were in service. Another 1½ mile has since been opened, and a further important section, operating in the San Vicente district, is expected to be completed and opened for public service during this month.

Alldays and Onions Pneumatic Engineering Co., Ltd.—The directors have declared the usual annual dividend of 5 per cent. per annum, together with the usual bonus of 5 per cent. on the ordinary shares, making 10 per cent. for the year.

Dorman, Long & Co., Ltd.—The directors announce a final dividend of 3½ per cent., making 6 per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

In most departments of the Stock Exchange there is a fair amount of business going on. The continued ease in the money market, and the feeling that foreign disturbances are not likely to unsettle the home securities, have combined to lead the investor back to Stock Exchange paths; nor is the spirit of speculation entirely absent. New issues are beginning to make their appearance again, and the coming winter promises to be fruitful in a crop of electrical issues concerned mostly with power and traction undertakings abroad.

Amongst these new issues, one of the earliest will be £150,000 5 per cent. Debenture stock offered by the South American Light and Power Company. The prospectus will probably be out before we are. There is a good deal of demand for the underwriting, and, as usual, a certain amount of disappointment on the part of people who thought they had a right to be allotted more than was the case. Of recent new issues, that of the Anglo-Argentine Tramways Debenture stock has improved to 1¼ premium, while the Mexican Light and Power Second Debenture is called nominally par—that is to say, the issue price of 87. Until the underwriters have disposed of more of their stock in the case of the latter, the quotation will probably remain at about its present level.

Another new introduction to the market this week is the Ordinary share of the Manaos Tramways and Light Company. The shares were introduced at 15s., and were quickly put up to 16s. 3d. The company is doing well, and there is a dividend within sight on the Ordinary shares. It may be suggested, however, that the Ordinary shares of the La Plata Electric Tramways are, perhaps, as good an investment as those of the Manaos, and the price is half-a-crown cheaper. Manaos Debenture rose 2 points to 93 middle upon the introduction of the junior security.

The Home Railway market continues to provide excitement and rapid movements. After the meetings of the railway men last Sunday the market advanced strongly, and most of the steam stocks were put up in a substantial manner. With them rose Metropolitan Consolidated to 42⅜, and Districts at 30½ showed a rise of the fraction. On the other hand, Central London Ordinary eased off a little after its rise of last week, and City and South London fell ½. Renewed attention is being directed to East London Ordinary, and the price is firm at 6½, which is only some 4 points lower than that of the company's "D" Debenture stock.

British Electric Traction shares are a duller market, and while it is expected that the modified scheme of the directors will be duly confirmed, the recent buyers have withdrawn their support, and the market is quietly dull. Potteries Ordinary, however, are firm, and the Preference rose 1/8 to 12s. 1½d., while the Ordinary again advanced to a similar extent. London United Tramways are easier at 3¼. The proposal made the other day that the London County Council should run motor-omnibuses sent rather a shiver through those who had been following the rise in London General Omnibus stock; and although it is not thought that the proposition will come to anything definite, the mere fact of this new bogey having been raised acts as a deterrent to buyers. Underground Electric Railways Income Bonds lost their rise of last week.

English Electricity Supply shares are distinguished by a further rise in County of London Ordinary, which has taken up the price 7s. 6d. to 8⅛. It is stated that the company has been so fortunate as to increase in a material degree its day load, and, on this, anticipations are being raised of an improvement in the dividend. Some people look for 6 per cent. in respect of the current year, and if these expectations are realised, it is quite on the cards that the shares may rise even higher. South London Ordinary rose ⅛, and Westminsters at 7¾ are better to the same extent.

The Canadian-Mexican group shows pronounced strength, and there are rises in nearly all the leading issues. Montreal Light, Heat and Power has recorded another rise of 4 points. Shawinigan Water is up 3. Mexican Light and Power Ordinary rose 2½, and the Preference 1½. Mexico Trams gained 1½, and Sao Paulo Trams 2⅛, the only shares in this section to show a decline being Rio Trams Ordinary, which have gone back 1½ on the fears of competition, to which reference was made in this column two or three weeks ago. Amongst the bonds the movement is in the same direction, although, of course, the improvements are on a smaller scale. There is a large volume of business being done. British Columbia Preferred and Preference stocks have improved, and Calcutta Preference rose ¼ on the expectations of the Durbar festivities. Anglo-Argentine Tramways Second Preference at 4⅞ are ⅛ higher. Cape Electric Trams recovered the dividend of 6d. which was deducted last Friday.

We understand that an offer will shortly be made of 3 million dollars 5 per cent. Prior Lien bonds by the Puebla Tramway, Light and Power Company.

In the Telegraph list there is not much change. Marconis slipped back a trifle, but West India and Panama shares regained their little loss of last week on the announcement of another dividend of 1s. 6d. per share, the accounts showing that the company is in a position to pay at least as much again had the directors decided to adopt a less conservative policy. The Anglo and the Eastern groups are both steady. American Telephone and Telegraph Capital stock rose 3, and the Collateral Trust bonds 1, upon buying from the other side.

The feature in the Telephone section has been a rise of no less than 7 points in National Telephone Deferred, the quotation shooting up to 126, with a regular flurry amongst the bears to help it. There are rumours that the Government may make an issue of Exchequer Bills in order to pay out National Telephone proprietors at the end of this year. New York Telephone bonds are harder. The only changes in the rest of the list are ⅛ rise in Oriental Ordinary and 1/16 fall in the Preference.

Manufacturing companies are distinguished mainly for a strong rise in Edison & Swan shares of both classes. The partly-paid shares rose 1/16, and the fully-paid ⅛; the buying seems to be based on the recent report, which, while it was distinctly good, had no effect upon the prices at the time of its issue. There has been a little demand for Willans & Robinson. Telegraph Constructions put on another 10s., but lost it again. Castner-Kellner rose ⅛ on a capital report, showing that the dividend on the shares is to be raised from 17½ to 20 per cent. Babcocks continue their upward march. Brush Ordinary and Preference have had their nominal quotation lowered to 0—¼ in both cases.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Nov. 8	2,666	+ 34	23	86,158	+ 1,952	..	..
Ayr	„ 11	377	+ 8	26	9,678	+ 40	8	..
Bath	..	..	..	..	..	..	..	..
Birkenhead	„ 12	2,230	+ 19	32	87,408	+ 1,346	13·7	..
Birmingham Corp.	„ 4	18,897	+4,788	31	261,154	+48,680	56·4	..
Blackburn	„ 8	2,125	+ 158	32½	38,700	+ 3,282	14·6	..
Blackpool Corp.	„ 9	1,0?6	+ 104	..	55,283	+ 7,148	..	..
Blackpool-Fleetw'd	„ 11	506	+ 88	19	24,057	+ 1,961	..	..
Bolton	„ 5	4,888	+ 862	32	80,994	+ 5,436	26	..
Bournemouth	„ 8	3,088	+ 186	32	61,134	— 730	22	..
Bradford	„ 4	10,449	+ 405	31	175,179	+19,224	56	1·2
Brighton	„ 12	1,685	+ 104	32	35,372	+ 2,128	9·5	..
Bristol	„ 10	12,424	+1,246	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 3	468	+ 37	44	9,743	+ 111	3·65	..
Barnsley	„ 3	378	+ 39	„	8,1?0	+ 598	..	..
Barrow	„ 3	601	+ 136	„	13,695	+ 1,869	5·37	..
Devonport	„ 3	1,002	+ 160	„	22,105	+ 3,257	8·86	..
Gateshead	„ 3	2,150	+ 124	„	46,056	+ 2,482	11·25	..
Gravesend	„ 3	411	+ 25	„	9,490	+ 318	6·5	..
Greenock	„ 3	1,899	+ 377	„	32,171	+ 4,613	7·25	..
Hartlepool	„ 3	606	+ 82	„	12,154	+ 1,120	6·72	..
Kidderminster	„ 3	194	+ 3	„	5,255	+ 292	..	..
‡Leamington	„ 3	2?3	+ 11	„	7,965	+ 388	..	..
Merthyr	„ 3	395	— 8	„	9,260	+ 123	2·9	..
Metropolitan	„ 3	17,125	+2,319	„	389,640	+28,028	22	..
Middleton	„ 3	609	+ 14	„	15,203	+ 1,202	8·5	..
Mid. Joint Com'tee	„ 3	8,428	—3,491	„	234,474	—21,144	..	..
Oldham—Ashton	„ 3	1,145	+ 31	„	25,451	+ 966	9·13	..
Peterborough	„ 3	241	+ 37	„	5,752	+ 573	5·31	..
Potteries	„ 3	4,248	+ 290	„	86,078	+ 7,960	29	..
Rothesay	„ 3	81	— 6	„	9,882	+ 57	2·75	..
Southport	„ 3	501	+ 14	„	13,651	+ 524	8·17	..
S. Metropolitan	„ 3	1,544	+ 22	„	38,696	+ 1,988	..	..
Swansea	„ 3	2,2?6	+ 151	„	50,745	+ 2,940	13·5	..
Tynemouth	„ 3	3.0	— 22	„	11,?88	+ 387	3·75	..
Weston-s-Mare	„ 3	68	..	„	8,025	+ 1,043	3	..
‡Worcester	„ 3	542	+ 19	„	13,216	+ 581	5·75	..
Wrexham	„ 3	205	+ 21	„	4,522	+ 225	..	..
Yorks. Wool. Dist.	„ 3	2,130	+ 133	„	46,699	+ 3,064	17	..
Miscellaneous	„ 3	422	+ 40	„	10,098	+ 586	..	..
Burnley	„ 11	2,?00	+ 279	..	..	..	11·7	..
Burton-on-Trent	„ 12	531	— 5	32	9,551	+ 589	6·6	..
Bury	„ 12	2,847	+ 150	32	42,394	+ 3,661	22·5	..
Cardiff	„ 11	4,628	+ 408	32	80,652	+ 6,241	..	..
Chatham and Dist.	„ 9	1,664	+ 68	45	38,780	— 27	15	..
Cork	„ 9	?52	— 13	45	22.?85	+ 544	9·89	..
Croydon	„ 8	3,333	+ 120	31	57,800	+ 4,088	11·4	..
Darlington	„ 11	426	+ 22	38	7,340	+ 690	..	..
Darwen	„ 10	516	+ 24	32	8,761	+ 676	4·36	..
Dover	„ 4	437	+ 54	31	8,6?7	+ 1,288	4·75	..
Dublin	„ 10	10,?39	+ 149	..	121,489	+10,947	54·2	..
Dundee	„ 8	2,216	— 82	25?	30,300	— 797	15	..
East Ham	„ 11	2,106	+ 13	32	35,712	+ 1,714	7·87	..
Exeter	„ 10	599	+ 23	32	11,623	+ 892	5·5	..
Glasgow	„ 11	88,079	+2,960	..	452,0?7	+31,216	98	..
†Hastings	„ 9	?91	+ 32	..	..	+ 590	..	..
Huddersfield	„ 11	3,?46	+ 194	32	64,175	+ 6,825	29·5	1
Hull	„ 11	5,827	+ 397	32	93,?28	+ 4,842	14·5	..
Ilkeston	„ 9	243	+ 6	32	4,329	+ 75	..	..
Ipswich	„ 11	?10	+ 48	32	15,248	+ 865	10·5	..
Kilmarnock	„ 11	299	+ 18	26	4,400	+ 357	4·25	..
Lancashire United	„ 8	2,482	+ 190	45	61,068	+ 2,072	39	..
Leeds	„ 4	14.994	+1,334	31	238,351	+16,177	50·75	2
Leicester	„ 11	4,878	+ 366	..	..	..	..	..
Leith	„ 11	1,164	+ 108	25?	17,542	+ 1,254	8·7	..
Liverpool	„ 4	23,022	+1,016	44	504,823	+15,521	116	3·5
‡L.C.C.	„ 1	86,870	+3,025	..	1,369,784	+72,644	140	8
London United	„ 11	11,343	+ 649	..	296,429	+ 9,905	..	..
Lowestoft	„ 11	380	+ 46	6	1,128	+ 20	3·5	..
Manchester	„ 11	31,744	+1,386	32	526,590	+27,809	133	..
Newcastle	„ 11	8,306	+ 817	..	188,032	+ 9,688	14·5	..
Newport	„ 4	1,249	+ 48	31	22,492	+ 877	14·5	..
Oldham	„ 12	3,682	+ 271	33	64,678	+ 2,887	23·75	·5
Pontypridd	„ 11	296	+ 17	32	13,508	— 16	5·5	..
Portsmouth	„ 4	3,621	+ 96	31	68,804	— 6,195	15·25	..
†Preston	„ 1	736	+ 16	31	24,851	+ 1,855	..	..
Rotherham	..	..	..	..	..	..	..	..
Salford	„ 6	9,369	+ 314	31?	155,180	+ 6,846	..	..
Sheffield	„ 14	18,002	+ 798	..	213,204	+18,607	40	..
Southampton	„ 8	2,298	+ 216	32	41,017	+ 5,075	22	..
Southend-on-Sea	„ 8	1,019	+ 171	32	24,690	+ 3,684	..	..
South Shields	„ 11	1,145	+ 130	31	20,660	+ 2,173	..	..
Swindon	„ 8	306	+ 29	..	5,257	+ 562	..	..
Tyneside	„ 8	869	+ 170	19	10,080	+ 1,431	..	..
Wallasey	„ 11	1,960	+ 168	32	36,856	+ 5,275	..	..
Walthamstow	„ 11	1,312	+ 70	32	25,261	+ 1,610	9	..
West Ham	„ 2	5.350	+ 393	31	85,480	+ 7,669	15·25	..
Wolverhampton	„ 8	1,902	+ 95	32	32,076	+ 1,936	25	..
Cen. London Rly.	„ 11	10,581	— 817	19	87,901	—14,845	6·32	..
City & S. Lon. Rly.	„ 12	6,742	+ 18	19	59,516	— 35	7·26	..
Dublin-Lucan Rly.	„ 10	238	— 8	19	3,026	— 51	7	..
G.N. and City Rly.	„ 11	3.108	+ 54	19	26,608	+ 498	3·5	..
L'pool Overh'd Rly.	„ 12	2,846	+ 245	..	28,816	+ 1,615	6·8	4·2
Llandudno-Col. Bay	„ 10	590	+ 27	49½	15,003	+ 583	..	..
London Elec. Ry. Co.	„ 11	30,060	+1,795	19	228,360	+ 7,620	21·25	..
Mersey Railway	„ 11	4,149	+ 190	19	36,168	— 1,878	4·5	..
Metropolitan Rly.	„ 12	35,438	+ 116	19	313,207	— 5,265	24·5	..
Met. District Rly.	„ 11	25,260	+1,471	19	209,356	+ 9,896	24	..
Anglo-Argentine	„ 11	98,981	+2,597	..	2,196,174	+186,955	..	..
‖Auckland	Oct.	16,485	+1,412	..	64,857	+ 5,028	23·3	·5
Bombay (B.E.T.)	Oct. 13	6,888	+ 874	41	117,519	+ 7,172	..	..
‖Brisbane	Oct.	21,890	+2,690	40	205,980	+24,290	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 11	8,063	+ 910	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
‖Kalgoorlie, W.A.	Oct.	3,251	..	..	84,779	..	20·5	..
‖Lisbon	..	..	..	..	..	..	..	..
Madras	Oct. 31	1,505	+ 148	..	29,960	+ 2,602	..	..
‖Montevideo	Oct.	25 084	+2 022	52	298,858	+18,563	..	..
Perth (W.A.)	Nov. 10	3,258	+ 322	..	72,541	+16,018	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. ‖ One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	7¾ — 8¼	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	5 10 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅝	..	4 7 5
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 6
Brompton & Kensington, Ord.	5	10	9†	7⅝ — 8⅛	..	6 3 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 7⅞	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —102	..	3 18 5
Charing Cross, West End & City	5	5	5†	3⅜ — ⅞	+ ⅛	6 9 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅜ — 4⅛	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	5	4†	3⅞ — 4⅛	..	5 14 8
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	6†	12¼ — 12⅝	..	5 9 10
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12⅛	..	4 14 1
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	+1	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	4†	8⅝ — 9⅛	+ ⅛	4 18 8
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	100	Nil	Nil	2 — 2½	..	Nil
Do. 5 % Deb.	100	4½	4½	82 — 85	..	5 5 11
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 9 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	⅜ — ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅜ — 3⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	96½ — 98½	..	5 1 6
Mexican El. Lt., 5 % 1st M. Bds.	$100	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	91½ — 92½	+2½	4 6 6
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+1½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8	185 —190	+4½	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	84 — 86	..	13 17 10
River Plate, Ord.	Stock	10	..	223 —228	..	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	124 —126	+3	3 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½ —104½ xd	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11¾d.	1/16 — 1/8	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ —108½	..	5 10 7

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6¾ — 7 xd	..	6 1 5
Do. 5 % Pref.	5	5	5	4¼ — 5⅛	— ¼	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	..	5 1 6
Canadian Gen. El. Com.	$100	7	7†	115 —120	+9	5 14 9
Do. 7 % Pref.	$100	7	7	118 —122	..	5 16 8
Cordoba Lt., Power and T., Ord.	1	3	..	1/32 — 1/16	+ 1/32	3 4 0
Do. 5 % Deb.	100	5	..	93 — 96	..	5 4 2
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 9 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	⅜ — ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	..	..	2⅜ — 3⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	96½ — 98½	..	5 1 6
Mexican El. Lt., 5 % 1st M. Bds.	$100	5	5	88 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	91½ — 92½	+2½	4 6 6
Do. 7 % Cum. Pref.	$100	7	7	108 —110	+1½	6 7 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95½ — 97½	..	5 2 7
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	..	5 8 8
Montreal, Lt., H. and Power	$100	7	8	185 —190	+4½	3 13 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	84 — 86	..	13 17 10
River Plate, Ord.	Stock	10	..	223 —228	..	4 5 10
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —112	..	5 7 2
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	124 —126	+3	3 3 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½ —104½ xd	..	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	11¾d.	1/16 — 1/8	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106½ —108½	..	5 10 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Amazon Telegraph	10	Nil	..	7¼ — 8¼	..	..
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8†	143 —145	+3	5 10 4
Do. Collat. Trust	$1000	4	4	94½ — 96½	+1	4 2 11
Anglo-American Telegraph	Stock	3¾	3†	67 — 69	..	5 8 8
Do. 6 % Pref.	Do.	6	6	110¾ —111½	..	5 7 7
Do. Def.	Do.	80/-	..	25½ — 26⅜	..	5 13 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	7	..	6¾ — 7⅛	..	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87 — 89	..	4 9 11
Cuba Telegraph	10	6	6†	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8¾ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	..	7⅜ — 8¼	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	5†	136 —139	..	5 0 9
Do. 8½ % Pref. Stock	Do.	3½	3½	83½ — 85½	+ ½	4 1 10
Do. 4 % Mort. Deb.	Do.	4	4	100⅜ —102⅜	..	3 18 1
Eastern Extension	10	7	5†	13½ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ —100½	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6	10½ — 11	..	5 6 10
Do. 6 % Pref.	10	6	6	12¾ — 13⅜	..	4 9 9
Great Northern Telegraph	10	18	5†	32¾ — 33¾	..	5 8 3
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	87 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	73 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	5	..	2⅜ — 2½	— 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	1⅞ — 2⅛	..	..
Monte Video Telephone, Ord.	1	5	6	⅛ — 1/16	..	5 12 11
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	5 6 8
National Telephone, Pref.	Stock	6	6†	103½ —105½	..	5 13 9
Do. Def.	Do.	6	6†	125 —127	+7	4 14 6
Do. 6 % Cum. 1st Pref.	10	6	6	9⅜ — 10⅛	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10⅛	..	5 17 1
Do. 6 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	..	4 9 11
Do. 5 % Deb.	Stock	5	5	99 —101	..	3 9 4
Do. 3½ % Deb.	Do	3½	3½	99 —101	..	3 19 3
Do. 4 % Deb.	100	4	4	100½ —101½	+ ½	4 8 11
New York Telep., 4½ % Gen. Bnds.	1	4½	4½	1⅜ — 1⅝	— 1/32	4 18 6
Oriental Telep. and Elec.	1	8	..	1⅜ — 1½	— 1/32	4 16 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 8 5
Do. 4 % Red. Deb.	Stock	4	4	82½ — 90½	..	3 18 10
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	4 5 3
Reuter's	8	5	5†	87 — 92	..	4 10 3
Submarine Cables Trust	Cert.	6	6	180 —183	..	4 9 1
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	5 6 8
United River Plate Telephone	5	8	8	7¾ — 7⅞	..	4 10 11
Do. 5 % Cum. Pref.	5	5	5	5⅝ — 5¾	..	4 15 3
West Coast of America	2½	2½	2½	1/16 — 1/8	..	3 19 7
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	98½ —100½	..	4 3 4
West India and Panama Teleg.	10	1½	..	2⅜ — 3	+ 1/16	5 11 7
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10⅝	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	4 16 2
Do. 5 % Debs.	100	5	5	102 —104	..	5 0 0
Western Telegraph, Ltd.	10	7	6†	13⅛ — 14	..	3 17 8
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 13 9
Western Union Tel., 4 % Bnds. A	$1000	4	4	105⅛ —108⅜	..	4 8 3
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99 —102	..	

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1 1/16	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1 1/16	— 1/16	Nil
Do. 6 % Pref.	10	1½	1½	3 7/16 — 4 1/16	— 1/16	3 8 7
Do. 5 % Deb.	100	5	5	93 — 96	..	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82	—1	5 9 9
Central London Railway, Ord.	100	3	3†	67 — 69	—1	4 5 9
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	51 — 53	..	3 15 6
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1 3/4†	30½ — 31½	— ½	4 14 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	[illegible]	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 1 1/16	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/16 — 5/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 15/16 — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	3 — 3 1/16	— 1/16	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Nov. 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1 3/8	2†	42 3/16 — 43	+1	3 4 0
Do. Surplus Lands	100	2 3/8	3†	65 — 67	..	4 2 1
Do. 3½ % Deb.	100	3 1/2	3 1/2	89 — 91	+1	3 17 0
Do. 3½ % Pref.	100	3 1/2	3 1/2	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3 1/2	3 1/2	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	30 1/4 — 30 3/4	+ 1/2	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3 1/2	4½†	86 — 88	..	3 13 10
Do. 3½ % Gtd.	100	3 1/2	3 1/2	73 — 75	..	4 18 4
Metropolitan Elec. Trams, Ord.	1	5½	5†	32/32 — 33/32	..	5 12 4
Do. Def.	1	Nil	..	32/32 — 33/32	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1 1/16	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	100½—102½	..	4 7 10
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Potteries, Ord.	1	2	..	2/32 — 3/32	+ 1/32	..
Do. 5 % Pref.	1	5	5	28/32 — 29/32	+ 1/16	6 19 0
Do. 4½ % Deb.	100	4½	4½	87½ — 90½ xd	..	4 17 2
South Metro. Trams, 6 % Pref.	1	6	..	5/8 — 3/4	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 3 11
Underground Elec. Railways	10	..	..	1 3/8 — 2 1/8	..	..
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1	1½†	64 — 66	—1	1 9 8
Do. Power House Debs.	100	4	4	100 —102	..	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	..	2/32 — 3/32	..	Nil
Do. 6 % Pref.	5	Nil	..	2 1/8 — 2 3/8	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½†	4 15/16 — 5 3/16	..	4 16 5
Do. 2nd Pref.	5	5	5½†	4 15/16 — 5	+ 1/16	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	100½ —102½	+ ½	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/8 — 11 1/8	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98½ —100½	..	4 19 6
Brisbane Trams Invt., Ord.	5	8	8†	7 1/2 — 7 3/4	+ 1/4	5 3 3
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/4	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	..	143 —147	..	5 8 10
Do. Pref. Ord.	100	6	6	124 —128	+1	4 13 9
Do. 5 % Pref.	100	5	5	109½ —112½	+ ½	4 8 11
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99 —102	..	4 8 3
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 3/4 — 6 1/4	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5 1/4	+ 1/8	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	2 3/8†	7/16 — 1/2	..	4 0 0
City Buenos Aires Trams (1904)	5	5	5	5 3/8 — 5 1/2 xd	..	4 5 1
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	£1000	5	5	101½ —104½	..	4 15 8
Kalgoorlie Elec. Trams	1	Nil	..	31/32 — 1 1/32	..	Nil
Do. 5 % A Deb.	100	5	5	92 3/4 — 95 3/4	..	5 4 9
Do. 6 % B Deb.	100	5	6†	62 — 66	..	7 11 6

La Plata Elec. Trms, Prf.	1	6	6	31/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1 1/8	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1 1/8	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	..	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 99	+1	5 1 0
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 94	+2	5 6 5
Manila Elec. R. and Ltg., Bonds	£1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	125 —127	+1½	5 10 3
Do. Gen. Con. 5 % Bonds	..	5	5	98½ —100½	..	4 19 6
Do. 6 % Bonds	100	6	6	103 —105	+2	5 14 3
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 5/8 — 7 1/8	— 1/8	6 18 0
Do. 6 % Pref.	5	6	6	5 1/4 — 5 3/4	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½ —101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 3/8 — 1 7/8	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101½ —103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 1/2	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	116½ —117½	—1½	4 5 1
Do. 1st Mort. 5 % Bonds	..	5	5	101½ —102½	..	4 17 7
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10†	187 —191	+2½	5 4 9
Do. 5 % 1st Deb.	$500	5	5	104½ —106½	..	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	6	7	5 1/2 — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5 1/2	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4 3/8	106 —108	..	4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 11/16	..	Nil
Do. 6 % Pref.	1	9	6	2 3/8 — 2 7/8	..	7 2 2
Babcock & Wilcox	1	26	24†	5 1/2 — 6 1/16	+ 1/16	4 6 0
Do. Pref.	1	6	6	1 3/8 — 1 5/8	..	4 0 0
B.I. & Helsby Cables	5	10	8†	6 1/2 — 7 1/2	..	6 17 11
Do. Pref.	5	6	6	5 1/4 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	8	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	57 — 60	..	6 13 4
Do. 6 % Prior Lien	100	6	6	100 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	— 3/16	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	— 1/8	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	10†	9 — 9 3/4	..	7 13 10
Do. Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	17½	20	33 — 33 1/4	+ 1/16	6 13 4
Do. Deb.	100	4½	4½	104 —108	..	4 3 4
Crompton & Co.	8	Nil	Nil	3/4 — 7/8	..	Nil
Do. Deb.	100	5	5	55 — 65	..	7 13 10

Dick, Kerr	1	5	..	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	11/16 — 13/16	+ 1/16	Nil
Do. fully paid	5	Nil	..	1 1/2 — 2 3/8	+ 1/8	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/4 — 3/8	..	6 13 4
Do. Pref.	2	7	7	1 1/32 — 1 1/16	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7 3/4 — 8 1/4	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9 1/2	..	5 5 3
Do. Deb.	100	4	4	86 — 91	..	4 7 11
Henley's, Ord.	5	15	10†	11 7/8 — 12 3/8	..	5 18 10
Do. Pref.	5	4½	4½	4 3/8 — 5 1/8	..	4 5 11
Do. Deb.	100	4½	4½	106½ —108½	— 1/2	4 2 7
India-Rubber, G. & T.	10	10	..	12 3/8 — 14 3/8	..	6 17 11
Do. Pref.	10	5	5	9 3/4 — 10 3/4	..	4 16 5
Telegraph Construction	12	20	10†	36 1/2 — 38 1/2	..	6 2 1
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	..	1/16 — 3/16	+ 1/16	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 8

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated upon the dividends paid for 1910.

Bank rate of Discount 4 per cent., September 21st, 1911.

SWEDISH EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical and similar goods from Sweden during the year 1909, have been taken from the recently issued official trade statistics; details for 1908 have been added for purposes of comparison, and notes of increases and decreases have been given :—

	1908. Kronor.	1909. Kronor.	Increase or decrease. Kronor.
Electric meters.—			
To Germany	12,000	8,000	— 4,000
„ Other countries ...	1,000	1,000	—
Total ...	13,000	9,000	— 4,000
Electric incandescent lamps.—			
To Finland	20,000	30,000	+ 10,000
„ Russia...	37,000	51,000	+ 14,000
„ Denmark	12,000	18,000	+ 6,000
„ Germany	8,000	11,000	+ 3,000
„ Netherlands	25,000	—	— 25,000
„ Great Britain... ...	25,000	33,000	+ 8,000
„ Argentina	32,000	38,000	+ 6,000
„ Other countries ...	25,000	21,000	— 4,000
Total ...	184,000	202,000	+ 18,000
Dynamos and parts thereof.—			
To Norway	113,000	183,000	+ 70,000
„ Finland	391,000	80,000	— 311,000
„ Russia...	1,000	56,000	+ 55,000
„ Denmark	74,000	19,000	— 55,000
„ Germany	25,000	36,000	+ 11,000
„ Great Britain... ...	67,000	27,000	— 40,000
„ Spain	8,000	26,000	+ 18,000
„ Portugal	35,000	13,000	— 22,000
„ Italy	—	29,000	+ 29,000
„ Australia	36,000	43,000	+ 7,000
„ British N. America ...	4,000	182,000	+ 178,000
„ Argentina	30,000	26,000	— 4,000
„ Other countries ...	18,000	7,000	— 11,000
Total ...	802,000	727,000	— 75,000
Electric motors.—			
To Norway	110,000	2,000	— 108,000
„ Finland	21,000	19,000	— 2,000
„ Great Britain... ...	49,000	59,000	+ 10,000
„ Australia	—	14,000	+ 14,000
„ British N. America ...	14,000	60,000	+ 46,000
„ Argentina	68,000	43,000	— 25,000
„ Other countries ...	24,000	24,000	—
Total ...	286,000	221,000	— 65,000
Transformers.—			
To Norway	10,000	6,000	— 4,000
„ Great Britain... ...	15,000	—	— 15,000
„ British N. America ...	—	11,000	+ 11,000
„ Other countries ...	1,000	1,000	—
Total ...	26,000	18,000	— 8,000
Telephone apparatus.—			
To Norway	21,000	51,000	+ 30,000
„ Finland	319,000	236,000	— 73,000
„ Russia...	718,000	719,000	+ 1,000
„ Denmark	321,000	595,000	+ 274,000
„ Germany	26,000	3,000	— 23,000
„ Netherlands	41,000	65,000	+ 24,000
„ Great Britain... ...	1,063,000	794,000	— 269,000
„ France	3,000	78,000	+ 75,000
„ Roumania	21,000	22,000	+ 1,000
„ Other countries ...	19,000	36,000	+ 17,000
Total ...	2,552,000	2,599,000	+ 47,000
Petroleum and benzine motors.—			
To Norway	259,000	359,000	+ 100,000
„ Finland	185,000	170,000	— 15,000
„ Russia...	712,000	1,808,000	+ 1,096,000
„ Denmark	23,000	86,000	+ 63,000
„ Germany	119,000	258,000	+ 139,000
„ Netherlands	19,000	64,000	+ 45,000
„ Belgium	19,000	41,000	+ 22,000
„ Great Britain... ...	20,000	18,000	— 2,000
„ France	7,000	28,000	+ 21,000
„ Italy	32,000	162,000	+ 130,000
„ Austria	34,000	125,000	+ 91,000
„ Argentina	21,000	29,000	+ 8,000
„ Other countries ...	28,000	53,000	+ 25,000
Total ...	1,478,000	3,201,000	+ 1,723,000
Turbines.—			
To Finland	33,000	42,000	+ 9,000
„ British N. America ...	—	11,000	+ 11,000
„ Other countries ...	8,000	19,000	+ 11,000
Total ...	41,000	72,000	+ 31,000
Accumulators.—			
To Norway	2,000	10,000	+ 8,000
„ Finland	6,000	10,000	+ 4,000
„ Germany	15,000	1,000	— 14,000
„ Other countries ...	6,000	4,000	— 2,000
Total ...	29,000	25,000	— 4,000
Rheostats.—			
To Norway	26,000	10,000	— 16,000
„ Denmark	4,000	3,000	— 1,000
„ Germany	7,000	5,000	— 2,000
„ British N. America ...	1,000	5,000	+ 4,000
„ Other countries ...	9,000	2,000	— 7,000
Total ...	47,000	25,000	— 22,000
Copper wire covered with textiles.—			
To Russia...	65,000	62,000	— 3,000
„ Denmark	120,000	101,000	— 19,000
„ Great Britain... ...	85,000	99,000	+ 14,000
„ Other countries ...	66,000	34,000	— 32,000
Total ...	336,000	296,000	— 40,000
Copper wire covered with rubber.—			
To Russia...	39,000	85,000	+ 46,000
„ Other countries ...	27,000	18,000	— 9,000
Total ...	66,000	103,000	+ 37,000
Steam turbines.—			
To Norway	—	23,000	+ 23,000
„ Finland	34,000	10,000	— 24,000
„ Russia...	66,000	192,000	+ 126,000
„ Germany	22,000	10,000	— 12,000
„ Netherlands	16,000	20,000	+ 4,000
„ Argentina	37,000	6,000	— 31,000
„ Other countries ...	29,000	8,000	— 21,000
Total ...	204,000	269,000	+ 65,000

Krona = 1s. 1½d.

New Zealand Budget and Electricity: Possible Developments.—The Budget proposals of the New Zealand Government contains some interesting references to the proposals for electrical development. "Inquiries are being made," said the Premier, "with a view to establish within the Dominion new electrochemical industries which would obtain their power supply from the Government mains. One of the most promising is the manufacture of chemical fertilisers, for which there is likely to be a large and increasing demand throughout the world. With the natural conditions obtaining in New Zealand, it is probable that products of this nature could be manufactured on a scale and at a price which would make the industry profitable in itself and of benefit to the whole community.

"Another feature of the development of our water powers on a large scale which would have an important bearing on the social life of the people, is its possible influence in the home. The problem of assistance in carrying on domestic work under existing conditions is one which is steadily becoming more acute in most civilised countries. A practical solution seems difficult of attainment, but will, doubtless, ultimately be reached by reducing the amount of personal effort required to attain a given degree of comfort. In my opinion, the day is not far off in New Zealand when, with an abundant supply of electrical energy available at a cheap rate, it will be within the power of most people to utilise the new power for all the lighting heating and cooking required without any trace of dust, dirt or excess of heat. The estimates of expenditure and revenue in connection with the Lake Coleridge project indicate possible prices for the supply of current which warrant the hope that such a consummation is within the range of practical development in New Zealand."

Sir Joseph Ward went on to say that the important question of electrifying the Lytellton Tunnel has been given careful consideration, and the electrical engineer, Mr. Parry, has been instructed to report upon this matter without delay, and to prepare the necessary plans with a view to the work being put in hand at an early date. He has also been instructed to furnish a report upon the utilisation of Lake Warkaremsana for the supply of electrical power for lighting and industrial purposes in the North Island. This is expected to be available at an early date, and it is hoped that the waste power latent there will before long be made available for the uses of the people.

NOTES ON THE INSULATION TESTING OF ELECTRICAL MACHINES.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

There is a wide divergence of opinion among engineers, as indicated by the insulation tests demanded in specifications for electrical machines, as to the real function of certain of the tests that are commonly applied. Some engineers pay special attention to insulation-resistance measurements, others to high-pressure tests applied either instantaneously or for a prolonged period. Again, some engineers specify all tests to be made cold, others hot—while, in some cases, the temperature conditions, which are very important, are entirely disregarded.

As regards insulation-resistance measurements made on complete machines, these really show the condition of the insulation as regards cleanliness and dryness, and afford no guide whatever as to the quality and reliability of the insulation employed. There is considerable misconception on this point, and it is frequently assumed that the insulation resistance of a machine is a measure of the quality of the

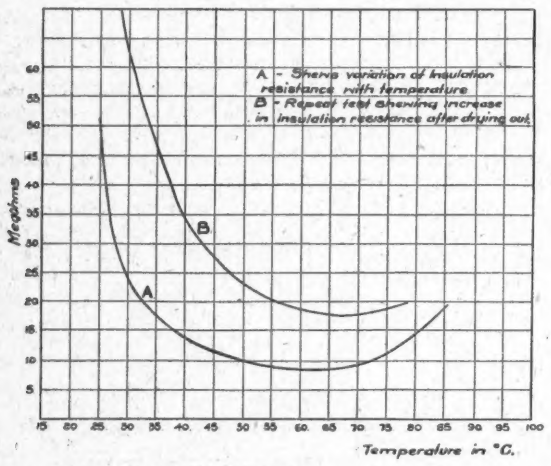

A - Shows variation of insulation resistance with temperature
B - Repeat test showing increase in insulation resistance after drying out
Megohms
Temperature in °C.

Fig. 1.

materials used. That this is not the case is evident when it is understood that no matter which of the commonly used materials, such as cotton fabrics, papers, mica and asbestos, are employed, prolonged drying will raise the insulation resistance to an almost unlimited extent, provided always that the surfaces of the insulation are perfectly clean.

In fig. 1 a comparison of curves A and B shows the increase in insulation resistance resulting from the drying-out of the windings of a 2,000-volt induction motor where the insulation consisted of paper, mica and tape. The curves also show the effect of temperature on the insulation resistance, and are typical of machines irrespective of the kind of insulation used, although as a general rule the decrease in insulation resistance as the temperature is raised is greater where organic materials, such as varnished papers and fabrics, are used than where those of a partly inorganic nature, such as micanite, are employed.

From the foregoing it might be inferred that a comparison of a number of insulation-resistance measurements obtained on machines over a certain period of time, and under similar temperature conditions, would afford a measure of the facility with which the insulation absorbs moisture. Such, however, is by no means generally the case, since in a moist atmosphere, long before the slot insulation has absorbed sufficient moisture to affect appreciably the insulation resistance, the exposed surfaces on the ends of the windings outside the slot portions will have become slightly conducting, due to deposits of moisture. The resistance will then be found to be greatly reduced solely through leakage over the surfaces from lightly insulated portions of the winding, or from bare copper, as in the case of direct-current machines. In the latter the insulation resistance is dependent almost entirely on the condition of the insulating surfaces between the commutator and iron, the actual leakage through the slot insulation usually being negligible. It will, therefore, be seen that insulation-resistance measurements of a machine are of negligible value as a guide to the quality of the insulating materials employed. On the other hand, both after erection and periodically during the operation of machines, they are of considerable value in indicating to what extent moisture and dirt are accumulating on the windings, and afford a warning as to the need for cleaning and drying.

Machines installed in chemical works may be cited as an example of this, where excessive leakage over end windings due to the formation of conducting deposits is particularly liable to cause failure. It must always be borne in mind, however, that it is the variation of insulation resistance from a well-seasoned condition, and not the value of the insulation resistance itself, which is of importance, and no hard and fast figure can be laid down as safe for machines under any particular condition. As a rough guide, however, the recommendation of the American I.E.E. may be taken, namely, "the insulation resistance of complete apparatus should be such that the rated voltage of the apparatus will not send more than 1/1,000,000 of the rated full-load current at the rated terminal voltage through the insulation. Where the value found in this way exceeds 1 megohm, it is usually sufficient."

As regards investigations of the properties of insulating materials themselves, while insulation-resistance measurements are of undoubted value in establishing comparisons, the importance of such measurements is often greatly over-rated. Measurements carried out with the necessary precautions taken to avoid surface leakage, can be made to show the comparative facility with which different materials absorb moisture. It frequently happens, however, in the case of fibrous insulation, that those materials showing the highest insulation resistance, and being the least absorbent of moisture, are by no means those most suitable mechanically, and in general the mechanical characteristics, such as flexibility, are of the greater importance. Any fibrous insulating material can, of course, be made to show a high insulation resistance simply by prolonged drying-out. It should be noted, however, that this often results in the removal of certain of the natural moisture which is necessary to give a fibrous material strength, so that an excessively high insulation resistance may merely indicate that the material has been ruined mechanically.

As regards pressure tests, these in general are only necessary during the time the machine is in the manufacturer's hands, *i.e.*, prior to putting into service. The principal function of a pressure test is to determine whether there is any mechanical damage to the insulation between windings and ground. The test at the same time affords some indication as to the sufficiency of the thickness and

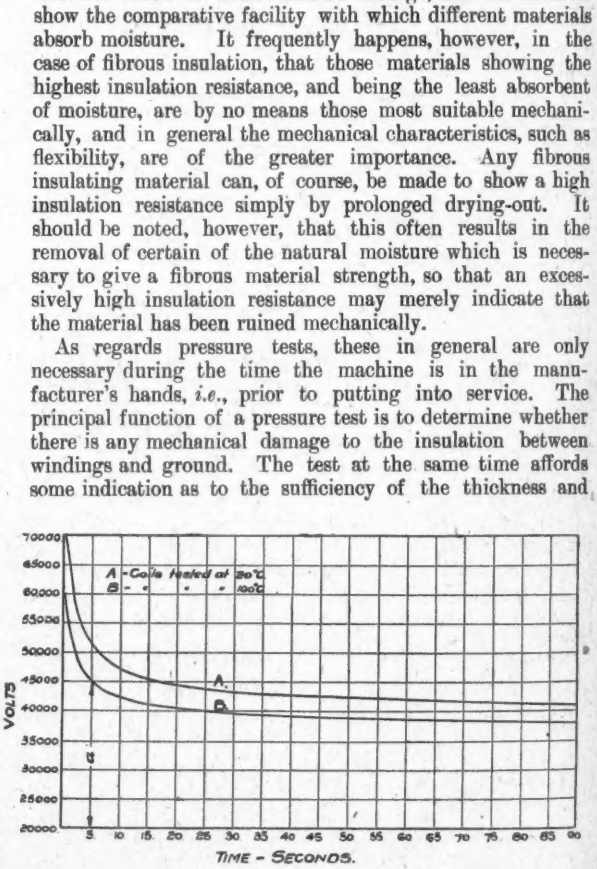


Fig. 2.

quality of the insulating materials used. It is evident that such a test affords no guarantee as to the reliability of the machine, since it imposes no test on the internal insulation, *i.e.*, between turns and sections of the winding, these being usually the more vulnerable parts. Such parts can only be tested at an early stage in the process of manufacture.

Further, a pressure test has no bearing whatever on the possibility of deterioration due to ageing of the insulation, this being determinable only by investigations of the characteristics of the materials themselves.

There is some risk of pressure tests weakening insulation, and the conditions under which such tests should be applied to prevent this have been the subject of much discussion among engineers in this country, on the Continent and in America. The principal risk likely to occur is that of the charring of the insulation due to internal heating, caused by the dielectric loss which is set up in insulation when it is subjected to alternating electrostatic stresses, this heating being more or less proportional to the square of the voltage. In a lesser degree, also, chemical action set up in occluded air spaces, as the result of electrostatic stresses, may cause some deterioration. Further, an effect similar to over-straining may also contribute to this weakening.

Since all these effects are intensified as the voltage increases, many engineers have advocated a moderately high-pressure test applied for a long period as preferable to a

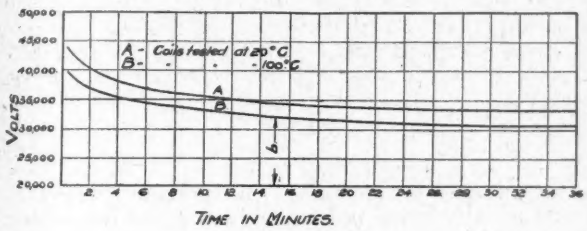


Fig. 3.

much higher pressure applied only for a very short time. Considered solely from the point of view of weakening due to internal heating, the problem resolves itself into determining the correct relationship between varying periods of time and the corresponding voltage necessary to produce breakdown.

Curves shown in fig. 2 indicate this relation for completely insulated coils tested under working conditions. From these curves it will be seen that a voltage *a* applied for five seconds produces the same tendency to breakdown—within the limits of uniformity of the value of the insulation—as a voltage *b* applied for 15 minutes.

Fig. 3 shows the same curves taken over a greater period of time. These curves are typical of all kinds of insulating materials.

An examination of the insulation thus tested indicated that the failures were in all cases due mainly to internal heating, the charring, however, being much more local in the short-time tests than where the voltage had been applied for a considerable time. While, therefore, a long-time test at a low voltage, or a short test at a higher voltage, may equally well cause a partial breakdown of the insulation, in actual practice cases of this kind are rarely experienced, since the factor of safety is usually very high, and, further, the insulation of the slot portions of the winding which are most severely stressed during testing is usually mainly of an inorganic nature, and, therefore, least affected by internal heating.

Where the slot insulation of the windings of a machine is made up of materials of widely differing specific inductive capacity, there is a danger, during the application of a high

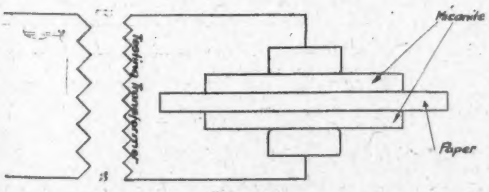


Fig. 4.

testing voltage, of actually causing disruption of the materials of lowest specific inductive capacity without producing any apparent weakening of the rest of the insulation. An experimental demonstration of this was made in the following manner:—Twelve sheets of paper ·005 in. thick were sandwiched between two sheets of ·06 in. micanite, the whole being placed between two flat electrodes of small area with all corners carefully rounded. The arrangement is shown in fig. 4. An alternating E.M.F. of 20,000 volts was applied between electrodes for a few seconds. The paper was then removed and examined microscopically, and numerous minute perforations were found in the portions under the electrodes. These portions were separately tested between the electrodes, and broke down when a pressure of 3,000 volts was applied, while those not coming under the electrodes required a voltage of approximately 10,000 to effect the puncture. It was, therefore, evident that the distribution of potential had been such as to impose a pressure exceeding half the applied voltage on the paper, though the latter constituted only one-third the total thickness of the dielectric.

Considered from other points of view, the high-voltage short-time test has some advantage over the low-pressure long-time test, inasmuch as it affords a better test of surface insulation, and is more likely to detect weaknesses due to defective workmanship. On the other hand, the duration of the test should not be so short that there is likely to be any serious error introduced in the time of application, since, as seen from fig. 2, there is a very considerable difference in the voltage which insulation will withstand if the pressure is applied for one second or two seconds. It would therefore seem that the test duration of one minute now standardised by the German Normalien, as well as the American Institute of Electrical Engineers, is a reasonable one. As regards the relationship between the pressure test and the working voltage, the agreement between the American and Continental engineers, that except with comparatively low-voltage work, the testing voltage shall be from twice to two and a half times the working voltage, appears to meet general requirements.

A danger not often recognised in applying pressure tests between windings of machines and ground lies in the possibility of causing short circuits between adjacent turns of

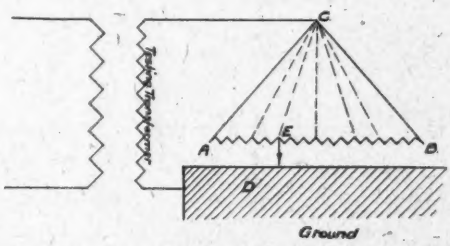


Fig. 5.

the coils. This is likely to occur if the test produces a breakdown to ground at a point in the winding, or if a flash-over occurs from the end of the winding to ground. This will be appreciated if reference is made to fig. 5. The entire winding of the stator is represented diagrammatically by A B, and connection from the testing transformer to winding and ground is shown made at the two points C and D. If now failure occurs to earth at the point E, either through the breakdown of the insulating materials surrounding the coils, or by a flash-over from the windings across the air-gap to the armature iron, the potential at the point E is suddenly reduced to zero, and the full testing voltage is thrown across the portion of the winding A E and B E, the slope of potential being greatest across those turns nearest the point E. The momentary voltage across these turns may easily be sufficient to puncture the insulation between them, and cases of failure due to this have been investigated by the writers.

The risk may be minimised by connecting the testing lines to as many points as possible on the winding, as indicated by the dotted lines. This also affords similar protection against the effect of surges liable to be set up if the testing voltage is suddenly switched on or off.

Turin Exhibition Awards.—The Swiss Insulating Works, Ltd., of Breitenbach-Basle (London representative, Mr. Archibald Campbell, Chancery Lane, W.C.) were awarded the Grand Prix for their insulating materials exhibits at Turin.

THE THREATENED NATIONAL COAL STRIKE.

By INTERESTED.

Some readers may think this matter has little in common with the electrical industry, but I can assure them it is very relevant. Electricity supply stations have hardly recovered from the lack of coal supplies consequent upon recent strikes, and the position of affairs now looming on the horizon, viz., the National Colliery Strike and Railway Employés' Strike, cannot but give rise to uneasy feelings regarding future supplies. The period of trouble through which this country has quite recently passed depleted the stocks of coal in most supply stations, and sufficient time has not elapsed since then to enable fair stocks to be accumulated again. Supplies have been intermittent and uncertain. Promises of early delivery have proved futile; and the prospect of supplies being received in sufficient quantities in the near future is shrouded in uncertainty. Inquiries made at the colliery districts have only elicited vague replies.

To think what might occur in the event of a general colliery strike before many months pass is appalling. The threatened position of affairs is very serious indeed. Electricity works, and gas works too, for that matter, without coal would be *hors de combat* in a few short weeks, so far as the provision of the necessary means of illumination for both private and public purposes is concerned. In Liverpool recent events cast a light upon the state of things which might be expected elsewhere under similar circumstances.

Everyone concerned—and the effect would be felt by many who, perhaps, are reposing in peaceful restfulness at present—must recognise the danger ahead; but what steps are being taken to guard against it, and to put their craft in readiness for the gathering storm, should it break eventually with renewed force upon us? No time should be lost in making provision for a probable stoppage of coal supplies. Quite a number of works there are whose storage space is limited, and those which have space and to spare cannot get coal to store just now. Barely sufficient free burning coal is obtainable to keep the plant running under normal conditions. Although I mention here free burning coal, the remark in some cases refers equally well to other classes of fuel.

What can be done to alleviate the trouble if matters take a bad turn? There seems to me to be one way only out of the difficulty, and that is, that large coal consumers such as electricity supply works must become ship-owners. More than once in articles appearing in the Electrical Review I have demonstrated the advisability of London stations having their own colliers. Now I speak in a more general tone, and refer to all works around the coast, at least in the more southern counties. We have already co-operative publicity; why not co-operation in the way of coal supplies? I certainly think such a scheme would be more successful than the publicity business. What is wanted, and wanted immediately, is that arrangements shall be made whereby coal can be carried direct from the most suitable seaport near any particular coalfield direct to any port in the country without interference from secondary interests. Take a concrete example. Suppose, for the sake of argument, that all works situated in the London area, within eight or ten miles of the coast line or river banks, were to combine and purchase two or more suitable ships for carrying coal. A big strike would then affect them in only one way, *i.e.*, difficulty in obtaining supplies and loading the same at the coalfield seaport. That could be overcome to a great extent when placing orders, by agreement with the colliery-owners. In the event of a combined coal and shipping strike, a little trouble might be experienced in loading the supply works' ships, but there the trouble would cease. In the event of many trades striking simultaneously, as recently proved the case, then away go the ships to fetch German coal. That is the other alternative; and it would prove a very useful lever in negotiating agreements with colliery-owners when stipulating for special arrangements for supplies during temporary stoppages of work.

These ships would be valuable assets in strike times, and, in addition, would be the means of saving many hundreds of pounds in coal bills for many works during times of peace. I mean that profits now gained by certain ship-owners, who control a big share of the carrying trade from Wales and the North, would be deflected into the pockets of those undertakings in the combination. Each works would have a free hand to purchase coal when and where it liked, the only agreement necessary being to arrange for deliveries by the ships so as to work one in with another. A council composed of one representative from each station could very well arrange a programme of working suitable to all.

Of course, there would be opposition to such a scheme as here outlined being inaugurated; that is to be expected. The rival interest—gas—has met the opposition already, and beaten it with gratifying results. And why not electricity works?

ECONOMIES IN ELECTRIC THEATRE WORKING.

[COMMUNICATED.]

If criticism is anything to judge by, then the kinematograph theatre has now reached its zenith, and as industries of this class do not stand still, the chances appear favourable to a decrease in the popularity of this form of amusement. This, of course, will bring corresponding financial depression.

As the whole industry of "moving pictures" is dependent on the class of film subject placed before the public, the manufacturers of these will be responsible if the fickle public do get tired of "pictures." That, however, is not exactly a matter for the engineer, although all branches are really linked together with that unstable coupling, £ s d.

Nevertheless, whatever happens to the film-making side, there is no doubt that economies must be made in the electrical side, immediately the pay-box receipts begin to fall off.

If not the greatest expense, the energy bill is certainly next to it; and though it may please the station engineer to see the units being eaten up, it is only a short-lived pleasure if the heavy bills help the consumer to bankruptcy.

As to what is the minimum current required to produce satisfactory results it is a little difficult to say, as so much depends on the quality of the projection lenses on the machine. It will be found that the ordinary commercial kinematograph lenses are very wasteful in light, and hence power; but by substituting lenses of the first quality, the energy bill can often at once be reduced by almost 30 per cent.

Another point where saving can be gained is the shutter. By using a shutter which opens in several places at a time, on the lines, perhaps, of an iris diaphragm, there will be a considerable decrease in the time required to change each picture, and this will allow more time for each individual picture to be left on the screen, resulting thereby in less dependence on the "persistence of vision," and giving a corresponding saving in energy.

Apart from the purely optical leakages, there are, however, many outlets for waste of energy due to the electrical equipment.

First, poor efficiency in the converter or motor-generator set may cause quite a considerable amount of loss in the course of a year, far outweighing the saving in the original cost of the "cheap" machine. That cheap means dear in the long run is, however, an old story.

The correct voltage for the generator is a very important matter. Although "plenty of volts" may be liked by the unskilled operator, yet the practice is very wasteful in resistance heating, which has of course to be paid for. A very satisfactory pressure is 65 volts. If higher, it is wasteful; if lower, there is apt to be unsteadiness in the arc.

With regard to arc voltage, the best results seem to be obtained with a lamp terminal voltage of 50 volts on D.C., and in the few cases where A.C. is used 35 volts is usually ample.

When will kinematograph workers and proprietors fully realise that the "length of throw" has nothing whatever to

do with the current required for a picture? It is the *area* that matters, so that when the electrical engineer is called in to advise on cutting down current, he should remember that considerable saving will accrue from reducing the area of the picture a little, and this should not detract from its quality; in fact, in many cases it will improve the steadiness of the picture on account of the reduced size.

The most satisfactory way of reducing the electricity bill is, of course, to reduce the price of energy, and there is no doubt that in many cases this really ought to be done, as many supply charges are abnormally high. Surely there is no real reason why electricity for kinematograph arcs should not be charged at power rates?

Perhaps some station engineers may have some excuse for charging at full lighting rates, but this is generally on account of the difficulty of maintaining a satisfactory supply, especially as the "kine" load is always on when least wanted, *i.e.*, at the "peak." In this respect it seems rather surprising that more use has not been made of accumulators, for it appears that a storage battery would give great satisfaction to all parties. Current would only be taken from the mains at night and morning, making a perfect "day" load, the discharge being during the "peak."

Practically, the arrangement would be to charge the cells in series and to discharge them in parallel. Thus, for example, on a 240-volt circuit at 2·5 volts per cell for the charging voltage, 96 cells would be required, and these, divided into three parts for discharge in parallel, would give from 67 volts to 58 volts (*i.e.*, from 2·1 to 1·8 volts per cell).

This is a most suitable arrangement for the cells, and they are worked under ideal conditions, being charged and discharged regularly. No regulating cells are required, for any variation in current, due to drop in voltage or other cause, is controlled by the series arc resistance.

Lighting for the hall is, of course, put direct on the mains; seeing that it forms only a small proportion of the total consumption, there is nothing to gain by putting it on the battery, as regulating switches, cells, &c., would then be necessary in order to keep the voltage constant.

Energy supplied from accumulators in this way would probably be quite as profitable to the supply station at power rates as energy supplied in the ordinary way at lighting rates.

Accumulator current is ideal for arc work, and more especially for kinematograph work, where steadiness is so necessary to good results.

On voltages lower than that given in the example, the line resistance has to be correspondingly reduced, but owing to the current being supplied from a battery, this does not have the detrimental effect it otherwise would.

If, however, more resistance, and hence a lower voltage be desired, the flame type of carbons may be used to advantage.

Current can often be saved in considerable amounts by changing the scheme of outside lighting. For example, the present popular idea is to have as much light outside the theatre as possible to attract the public, as though they were moths, and therefore unable to resist the bright light, into which they plunge! But surely it is possible to make the place quite as attractive with a far smaller current consumption.

For instance, the usual flame arc lamps could at once be displaced by, say, one mercury vapour lamp, which, placed fairly high up, would be quite as attractive owing to its mysterious colour.

Then, again, if every incandescent lamp on the front of the theatre were, say, red or green, the building would at once have such distinctiveness that it would immediately be called into prominence. The attraction depends on the quality, not the quantity of light.

The problem of running kinematograph arcs direct off alternating current is very attractive owing to the high efficiency which can be obtained, but practically it is found very objectionable owing to the alternation of the current.

The kinematograph pictures are in themselves sufficiently "alternating" in light and darkness without the addition of an alternating illuminant, and it is this reason that makes operators fight shy of A.C. It has been found, however, that the troublesome effect of the alternations may be considerably modified by using impregnated carbons, which tend to give a more "continuous" flame than the ordinary cored carbon.

There is no doubt that considerable savings can be made in the energy consumption at the general run of theatres without in the least affecting the qualities of the pictures, or the attracting power of the outside illumination. In short, this class of consumer is well worth looking after for his own, and hence our, sake.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Arising out of the success of the work of the Hydro-Electric Power Commission of Ontario comes the suggestion that the Dominion Government should create a new department, under the control of a Cabinet Minister, to look after all matters connected with the utilisation of water powers throughout the country.

A Commission, called the St. Lawrence River Commission, was recently appointed to inquire into all matters affecting the navigability of this great waterway. As there are many power schemes under consideration at the present time, which may interfere with navigation, this Commission will report on these in so far as they affect this question, and will also formulate principles to govern such schemes in the future.

In New Brunswick two hydro-electric power schemes are being considered. At Lepreuse, which lies some 20 miles south-west of St. John, power is to be developed from streams and lakes, and it is proposed to supply St. John itself with electric power. The second proposal, by the Eel River Light, Heat and Power Co., is to transmit power to Fredericton and other towns from a point on the Eel River, about 40 miles away.

The Grand Trunk Railway has abolished gas lighting in all sleeping cars running on routes from Montreal to Toronto, Detroit, Chicago, New York, &c., electric lighting by storage batteries having replaced the gas.

The municipal power station at Lethbridge, a rapidly growing town in Alberta, contains Babcock & Wilcox boilers and coal conveyors, also Belliss & Morcom engines, while all the steam piping and valves have been supplied by Messrs. Stewarts & Lloyds; this is a good record for British firms, but where are the electrical manufacturers? The electrical equipment was all supplied by a Canadian firm.

THE DELHI DURBAR, 1911.

[FROM OUR INDIAN CORRESPONDENT.]

In preparation for the Royal visit in December, the camping ground to the east of Delhi has undergone a complete transformation within the last few months. What was formerly a huge area of waste level ground behind the historic Ridge, is now a busy camp colony; miles of streets have been laid out, wide, straight and well metalled. On each side of these the various native chiefs have been allotted camping space. The areas of these allotments and their proximity to the Royal Camp vary roughly as the importance of the chief himself, and the number of gun salutes to which he entitled.

The Circuit House, where the Royal visitors will stay, the centre from which radiate, in the form of a huge three-quarter circle of about four miles radius, the various encampments. For the King and Queen and their guests spacious tents are arranged and luxuriously furnished. The *tout ensemble* forms a city of canvas, which has grown up with mushroom-like rapidity.

The first important problem which the Executive Committee of the Durbar had to consider was that of efficient

sanitation for the whole camp area. Expert opinions were sought early in the year, and with the experience gained at the 1903 Durbar, it is safe to predict that the sanitation of this Durbar camp will be excellent, considering the exceptional circumstances.

The next serious problem to engage the Committee was the provision of a pure and regular water supply. This has now been successfully arranged, and very great credit is due to the engineers who designed the scheme and carried out their arduous work and practically finished the whole water supply installation in a few months. There is a completely equipped pumping station on the banks of the river, from which a filtered supply is pumped direct to the mains. It is not easy to realise what a plentiful supply of pure water means to the native ; he needs it for his daily ablutions before meals, for cooking his rice and for drinking purposes ; and he requires a lavish supply. He is indifferent as to its purity so long as it *is* water, and it is therefore imperative on the authorities to provide a filtered supply only, so as to avoid sickness in camp.

The third serious question which occupied the thoughts of the Executive Committee was that of a thorough and efficient electric lighting scheme for roads and camps. At the 1903 Durbar, each camp was a law unto itself, no uniform system of electricity supply obtained, with the result that a forest of ugly, smoky, portable engine chimney stacks sprung up, which were not only unsightly, but were a positive source of discomfort and dirt.

All sorts and conditions of new and second-hand engine tackle were loaned to camps ; confusion and chaos, and very often complete darkness, reigned supreme in and around the temporary "power house."

Many of us who had charge of the operation of these isolated plants in 1903 are glad, indeed, that matters are simplified this year. Thanks to the initiation and foresight of the U. P. Government Electrical Inspector and his staff of assistants, a central distribution system, thorough in its completeness, has been laid down, and is at present ready for operation.

The central power house, which is situated outside the camp centre, consists of a large battery of Babcock and Wilcox boilers of a total evaporative capacity of 90,000 lb. of water per hour at a steam pressure of 100 lb. These are provided with chain-grate stokers and all the most modern types of pumps and economiser gear.

The smoke stack is a self-supporting steel chimney about 170 ft. high—an excellent piece of work for a temporary plant, and its erection was completed in record time. A few days after its finish a cyclone burst over Delhi, but this huge chimney weathered the storm without damage. Some Europeans expected, and the native was almost certain of. trouble, but engineering skill and sound workmanship baulked their anticipations.

The engine room is, as might be expected, cramped and congested ; but it is well equipped. It contains three generating sets of 750 KW. each, at 460 volts. The engines are by Belliss & Morcom and the dynamos by Siemens Bros. In addition to these large sets there are also some smaller units for light day loads ; and also some high-voltage A.C. sets for the military camps, which are a good distance away.

There is a well-equipped marble switchboard ; simple, yet complete, and of high-class workmanship. The arrangement is well thought out in its detail. A small battery of transformers for the A.C. sets, completes the power house equipment. All the above machinery was imported and erected in record time, in spite of the fact that towards the end of September the engine house floor became a veritable quagmire, due to a cyclone.

The mains for the whole camp are almost entirely overhead. Hamilton type telegraph poles are used, and no less than 400 tons of copper wire has been already fixed. The overhead network is simply arranged and neatly executed. The camp streets are laid out with the regularity and parallelism of a new American city ; at the side of a street the aerial mains are run, and from these latter the power and lighting feeders for adjacent camps at either side are connected and correctly balanced. The poles carrying the aerial mains also support water-tight street lighting brackets, of which there are thousands.

Alipore Road, the main thoroughfare, is already lighted, and the effect is good. When the whole camp is in full swing, all the miles of road lamps alight, and all the various native camps ablaze with illumination, the view from the flagstaff tower should be a magnificent one indeed.

The King's camp, which comprises the quarters in preparation for their Majesties and their personal guests, the Viceroy's camp and the camps of the various provincial governments will be handsomely and tastefully lit, and also will be provided with electric heaters (for the weather is intensely cold at night in December at Delhi).

The native chiefs' camps will be as gorgeously illuminated as the kilowatts allotted to each will allow. The kilowatts are allotted, as also the lamp space, roughly as the magnitude of the chief himself and the number of guns salute to which he is entitled, from the Nizam with his tens of kilowatts to the solitary chief who, it is said, is adverse to modern improvements, and who, as he must have electric light, has sanctioned one solitary 8-C.P. lamp for his gateway.

The whole of the wiring work is being carried out by about five firms of reputable contractors, the price per light having been fixed by Government at fair rates, and the work split up among those firms who were on the Government list. About 1,500 native wiremen are employed, each with his coolie, and superintended by about 30 skilled European engineers.

The central station equipment was supplied by Messrs. Siemens Bros., Belliss & Morcom, and Babcock & Wilcox, under the immediate supervision of their local resident engineers. The aerial mains were all erected by the Government Telegraph Department Engineers, who have also erected a wireless telegraph station and a system of telephones.

The entire equipment has been carried out under the direct and personal control of the United Provinces Electrical Inspector, Mr. J. Pit Keathly.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"D.C." writes : "A local authority, having obtained a loan for the purpose of establishing a supply of electricity, have now a certain surplus balance remaining, over and above the cost of the final scheme carried out. It is anticipated that the first two or three years' working of the undertaking will result in a deficit. The said local authority wish to avoid, if possible, drawing on the rates in order to meet this deficit. Can the deficits, during, say, the preliminary three years, be met by drawing on the balance of the loan ? Or, alternatively, can the local authority overdraw on the bank during the said period of time by special arrangement with the bank authorities ? Is either action legal, or permissible under the provisional order ?"

*** This query involves a discussion of the question whether money authorised by Parliament to be raised for one purpose can be devoted to another purpose. A search through the various Acts which authorise a local authority to borrow money fails to reveal any provision for the disposal of a surplus which may remain after the express objects for which the loan was raised have been carried out ; but it would be a dangerous experiment to devote that surplus to an unauthorised object. The auditor of the Local Government Board would probably surcharge those who made such a use of public money.

THE LONDON OPERA HOUSE INSTALLATION.

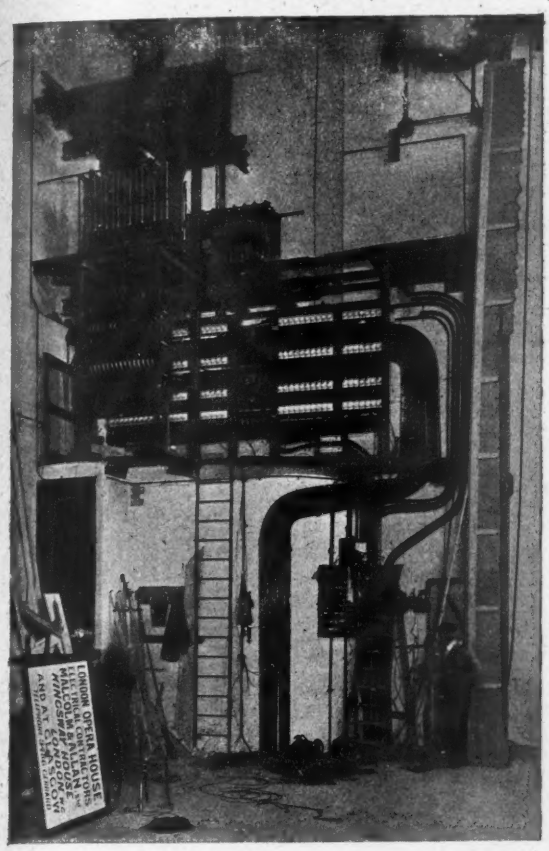
THIS, the most recent addition to the numerous places of amusement in London, is situated on the east side of Kingsway, and contributes not a little to the architectural features of what promises to be one of the finest thoroughfares of modern London.

It is almost unnecessary to add that the building and its appointments are in the first rank, and that a very extensive electrical equipment has been provided for both lighting and power, Messrs. Malcolm & Allan being the contractors for the work.

For the supply of electricity to the new buildings, services have been run by both the Charing Cross and Metropolitan Electric Supply Companies ; by the former to (*a*) the stage switchboard for stage and part of the general lighting, and to (*b*) a one of two front of

the house switchboards for other general lighting; by the latter company to (*c*) a power and special effects switchboard, for the supply of power, heating and for stage effects, to (*d*) a dressing rooms switchboard, and to (*e*) the other front of the house switchboard for supplying the rest of the general lighting. The lighting is on the three-wire system throughout with 200 volts across the outers, and the power service is at 200 volts pressure.

The stage is a large one, 84 ft. wide and 65 ft. in depth, while the proscenium opening is 45 ft. wide and 50 ft. high. The stage



THE STAGE SWITCHBOARD, LONDON OPERA HOUSE.

switchboard, on the "prompt" side, is some height above stage level and gives an excellent view over the stage; it is constructed in black slate, divided into four "circuit" panels and one panel for "black-out" switches for rapidly switching out the stage and auditorium lighting controlled from that point.

The service mains are of .9 sq. in. V.R. lead-covered steel-armoured cable; the four "circuit" panels control 78 circuits in all, with an aggregate capacity of 1,500 amperes, and have all the connections arranged in front in compliance with the L.C.C. regulations. The circuits, which are each controlled by a S.P. switch and D.P. "Zed" fuse, comprise 12 to the stage arc lights, &c., 32 stage circuits through dimmers, 20 auditorium circuits, also through dimmers, and 14 general stage lighting circuits. The regulators for the dimmers are mounted on the same platform as the above panels, while the dimmer resistances are on an overhead platform, the resistance contacts being coupled to the regulators below by means of wires passing over pulleys.

A feature of these resistances is a small carbon break switch, which the contact maker on its downward travel, when it has switched all the resistance into the circuit, finally opens, thus obviating unnecessary heating. The switch, of course, automatically closes again, when the contact maker commences its reverse travel. The whole of the stage switchgear is of Messrs. Siemens Bros. & Co.'s make, which was described in connection with the Palladium Theatre installation (ELECTRICAL REVIEW, January 20th).

In all about 2,300 metal lamps have been used for the stage lighting, including eight battens of 200 lamps, each in white, red, blue and amber colours, these being supplied through cast-iron connecting boxes in the flys, fitted with copper links and wing nuts; the battens are suspended over the stage from hand winches.

For the footlights there are 250 lamps in four colours, and 50 others for the proscenium in three colours. There are also 14 24-lamp "lengths" and six 12-lamp "bunch" lights, while 13 stage plugs are provided for arc and incandescent lighting. Six "lightning" arcs are provided, with a special switch at the prompt corner, also a similar number of stage projectors, with scissor shutters for colour, cloud, water and other effects, and two porthole projectors for special effects.

Illuminated word signal boards are provided in both flys, and a similar one in the prompt corner, with a 12-switch operating board below it for the stage manager, which allows of the latter verifying his instructions.

The stage service cables—as in the case of other services—enter a special intake chamber passing through the supply company's meters and a 750-ampere triple-pole knife switch and fuses in a locked iron case.

In the case of the service for the power and special effect switchboards, a similar arrangement obtains, but two 100-ampere power circuits and one 25-ampere power circuit, each with a D.P. switch and two-way fuses, are provided, for supplying a deep well pump, ventilating fans and for stage power, the circuits running through ironclad distribution boards. Cables also run from the main board in the intake chamber to the special effects board at the back of the stage.

For ordinary lighting the services are connected to two switchboards, one on each side of the main entrance, and controlling 37 and 78 circuits respectively; also to a dressing-rooms switchboard near the stage entrance, with 24 circuits.

All these boards are of similar design, with black enamelled slate panels, fitted with one tumbler switch and two "Zed" fuses per circuit. These boards were made by Messrs. Siemens Bros., and are enclosed in teak cases with glazed locked doors.

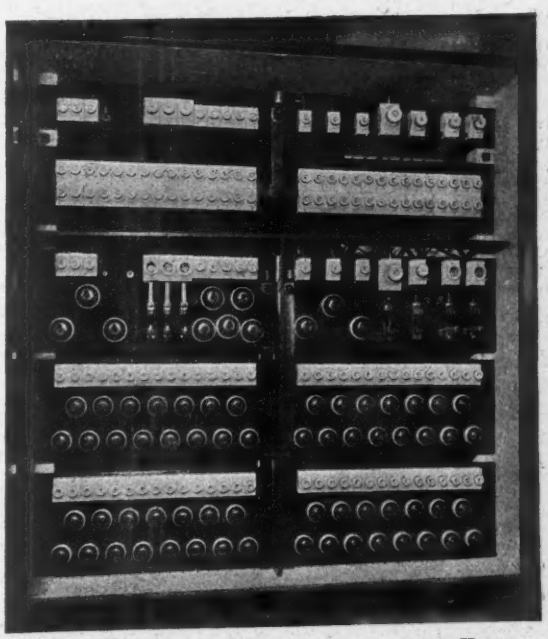
The bulk of the wiring has been carried out with 600 megohm C.M.A. cables and wires (of Siemens make) in screwed solid-drawn steel barrel, with Malcolm & Allan's special boxes; the wires were drawn through and looped-in throughout.

In all 38,000 yards of cable and wires and 30,000 ft. of tubing have been used. The dressing rooms, work rooms and staircases in parts of the house are surface wired with "Stannos" wiring.

Perhaps the principal feature of the auditorium, and of other parts of the house open to the theatregoer, is the concealed lighting. Thus, the ceiling of the auditorium contains a painted oval centrepiece surrounded by 400 lamps concealed behind the cornice, with Siemens reflectors, and in the centre of the centrepiece there are 160 lamps in four tiers, behind a glass sunlight disk, the fitting weighing a ton and being arranged for lowering to the ground. In the vaulted ceiling there is further concealed lighting, while electroliers, flambeaus, brackets, &c., provide the nearer illumination. In the vestible there are 115 lamps with Siemens reflectors concealed behind the cornice, and similarly in the box foyer 300 concealed lamps, together with conical bowl pendants, brackets, &c.

For the lighting of the verandah over the pavement some 300 lamps are used, while large candle-power metal lamps are also employed for exterior lighting.

In fact, metal-filament lamps are used throughout the building, for incandescent lighting—some 5,300 in all, representing about 200 KW.



FRONT-OF-HOUSE SWITCHBOARD, LONDON OPERA HOUSE.

Wherever the public has access to the building the dual lighting system (with two distinct sources of supply) has been adopted, so that a portion of the lighting in the auditorium, passages, boxes, saloons, &c., and on the stairs, will always be intact.

We may add that the interior fittings were specially designed for Mr. Crewe, the architect for the building, by Messrs. Veritys, Ltd., and are mostly of brass with gilt finish.

Reference has been made to the artesian well in one corner of the building, 450 ft. deep; from this a motor-driven pump lifts water to two 800-gallon roof tanks, which in turn feed other tanks for supplying lavatories, water heating, dressing rooms, &c.

The Plenum system of ventilation has been used, the two main ducts being formed at each side below the level of the stalls floor, from which branches formed in the concrete partitions, or of galvanised iron trunks, are carried to all parts of the house, in connection with four electric fans in the auditorium roof. The air heater is capable of raising the temperature 40°.

In conclusion, we are indebted to Messrs. Malcolm & Allan, the electrical contractors for the installation, and to Mr. Davidson, their manager, for enabling us to inspect the building and affording us facilities for this description.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

MOZAMBIQUE.—The Board of Trade has received definite information as to the actual amount of duty leviable on goods imported into Mozambique. From this information it appears that goods of foreign origin for importation into the territories of the Mozambique province, under the direct administration of the State, are subject to the following tariffs:—

1. Customs Duty.
2. Municipal Dues:
   (*a*) "Municipal," 50 % of the Customs duty.
   (*b*) "Commercial" 25 % of the Customs duty.
3. In addition, on goods imported into the territory south of the River Sane, a commercial contribution is levied at rates varying from 2 % to 15 % *ad valorem*.

ARGENTINE.—The Argentine Government has issued a decree providing that exemptions from Customs duty accorded by special laws in respect of machinery and materials for the installation of industries in the Republic shall, in cases where the respective laws establish only the amount of duty to be remitted without specifying any period of duration of the exemption, remain in operation for a period of two years after the enactment of the law. As regards tariff concessions in force prior to the promulgation of this decree, if the period of two years has already elapsed, a period of six months is accorded from the date of this decree (August 26th) in which to effect duty free importation.

CUBA.—With reference to Cuban requirements as to the certification by Consular officers of bills of lading for shipments to that country, the Board of Trade are informed that shippers may, when it suits their convenience, present, instead of the original set of bills of lading, an exact copy thereof bearing the following declaration: "*Este Conocimiento consular no es negociable, y son válidos sus efectos solamente para la Aduana.*" (This Consular bill of lading is not negotiable, and is valid only for Customs purposes.)

Nevertheless, persons in Cuba must, on declaring goods for entry at any Cuban Customs house, produce, together with the copy viséd by the Consul, the original bill which they receive as consignees of the goods, or which is endorsed to them by the consignees whose name appears on the bill or which is duly endorsed in case of consignment "to order."

NEWFOUNDLAND.—An Act (No. 11, of 1911) to encourage the manufacture of explosives in Newfoundland, provides for the exemption from duty, when imported by the British-Canadian Explosives Co., Ltd., London, for use in connection with their works and business in the colony, of all machinery and apparatus for the original installation.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,950. "Carbon-feeding mechanism of arc lamps." F. S. Worsley. October 30th.

23,960. "Sparking plugs of internal-combustion engines." F. A. L. Johnson. October 30th.

23,974. "Electric safety lamp." J. McCallum. October 30th.

23,979. "Flange electric holder and flange electric lamp terminal fitting together making a true and perfect connection." C. Harvey. October 30th.

23,990. "Electric arc lamps." A. H. Railing and A. E. Angold. October 30th.

24,008. "Electric switch." R. Heilbrun. (Convention date, November 3rd, 1910, Germany.) October 31th. (Complete.)

24,017. "Electrical heating or cooking apparatus." L. Newitt and F. P. Fletcher. October 30th.

24,027. "Electrically-heated cooking ovens and the like." A. F. Berry. October 30th.

24,030. "Protection of feeders of electrical distribution systems." C. H. Merz and P. V. Hunter. October 30th.

24,031. "Dry battery cells." J. Rudolphs. October 30th. (Complete.)

24,040. "Incandescent electric lamps." G. V. Deakin. October 30th.

24,098. "Process for swelling the sound by microphones, ear-end speaking trumpets, and the like." H. C. Petersen. (Convention date, November 11th, 1910, Denmark.) October 31st. (Complete.)

24,105. "Automatic regulating apparatus for electric supply systems." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckert Werke, G.m.b.-H., Germany.) October 31st. (Complete.)

24,122. "Electric transmission of power." H. B. van Daalen and H. P. Schreiber. October 31st.

24,138. "Electrical switch." A. J. Bonnella. October 31st.

24,141. "Electric timing devices." H. S. Hatfield. October 31st.

24,146. "Electric magnets." A. Quastenberg. (Convention date, November 14th, 1910, Germany.) October 31st. (Complete.)

24,154. "Electromagnetic relay apparatus." J. P. Coleman. (Convention date, November 2nd, 1910, United States.) October 31st. (Complete.)

24,158. "Electric lighting of vehicles." W. A. Trier. October 31st.

24,183. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 31st.

24,191. "Means of controlling current in electrically-heated apparatus." J. A. Abbott. November 1st.

24,215. "Manufacture of electric steels." V. Stobie. November 1st.

24,227. "Dynamo attachment for motor-cars and the like." J. S. Matthew and P. Burt. November 1st.

24,232. "Switches and resistances." C. W. Denny. November 1st.

24,238. "Process and apparatus for the electrolysis of aqueous solutions of metallic salts." R. Carl. (Convention date, November 3rd, 1910, Germany.) November 1st. (Complete.)

24,250. "Long tubular metallic-filament electric lamps." H. E. Angold and J. F. Pointer. November 1st.

24,258. "Insulating compounds." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 1st.

24,300. "Stand for supporting and facilitating the manipulation of photographic electric arc lamps." B. A. Quint. November 2nd.

24,305. "Miners' oil and electric lamps and apparatus in connection therewith." E. A. Hailwood. November 2nd.

24,321. "Electrical switches for use on motor vehicles, motor-cycles and other purposes." K. W. Brandl. November 2nd.

24,323. "Electrical conductor." T. H. Clarkson-Johnson. November 2nd.

24,333. "Hand-feed arc lamps." L. Kamm. November 2nd.

24,334. "Magnetically-operated puzzles or games." A. Oelling and A. W. Sharman. November 2nd.

24,352. "Electrical resistance heating cores." Sir R. A. S. Paget and J. F. Bottomley. November 2nd.

24,376. "Telegraph transmitters." G. H. Russell. November 2nd.

24,380. "Electric lamps for motor vehicles." H. Aron. November 2nd.

24,383. "Electric illuminating devices especially suitable for use on motor-cars." A. J. Bonnella. November 2nd.

24,384. "Switch especially applicable for operating electric motor horns." A. Hoffman and United Motor Industries, Ltd. November 2nd.

24,431. "Means for electrically lighting motor-cars and other vehicles and rolling stock." J. Polkey. November 3rd. (Complete.)

24,436. "Electric water heater and steam generator." A. P. Nichols. November 3rd. (Complete.)

24,441. "Impulse-transmitter for semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 3rd. (Complete.)

24,442. "Processes for producing directive forces by induction in alternating-current apparatus." H. Abraham and J. Carpentier. (Convention date, February 25th, 1911, France.) November 3rd. (Complete.)

24,445. "Electric water heaters." A. P. Nichols. November 3rd. (Complete.)

24,448. "Apparatus for electrically-igniting gas." E. W. Havers and Telephos Domestic and Street Lighting Co., Ltd. November 3rd.

24,449. "Circuit-breaker for transformers." J. Grob. November 3rd. (Complete.)

24,460. "Battery switches." E. C. R. Marks. (Siemens-Schuckert Werke, Germany.) November 3rd. (Complete.)

24,463. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 3rd.

24,482. "Articles made of silica glass and requiring leading-in wires combined therewith." H. A. Kent, H. G. Lascell and Silica Syndicate, Ltd. November 3rd.

24,532. "Device for branching-off electric conduits from a main conductor." J. E. Michler. November 4th. (Complete.)

24,552. "Electric lighting and heating of railway or other vehicles." Pintsch's Patent Lighting Co., Ltd., and C. H. Vidal. November 4th.

24,561. "Electric cut-outs." M. W. W. Mackie. November 4th.

24,562. "Process for reducing soluble metal salts for the purpose of subsequently electrolytically depositing the metals present in said salts." P. Marino. November 4th. (Complete.)

24,570. "Dynamo-electric machines of the compensated type." British Thomson-Houston Co., Ltd., and G. A. Neil. November 4th.

24,575. "Apparatus for obtaining a uniform longitudinal seam in tubes welded by electricity." Ges. fur Electrotechnische Industrie, m.b.H. (Convention date, November 5th, 1910, Germany.) November 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Telephone Receivers. B. O. Willis. 24,583. October 26th. (October 28th, 1908.)

1910.

Automatic Reversing Starters for Electric Motors. Höfle. 23,737. October 13th.

Device for Making Ordinary Clocks Reliable Electric Alarms. S. H. Walker. 23,780. October 14th.

Electric Time-Alarm Apparatus. H. Penner. 23,947. October 15th.

High-Frequency Electric Apparatus. M. Sanchez. 24,143. October 18th. (Convention date not granted.)

Armatures particularly Applicable to Magnets for Vibrating Diaphragms. W. D. Kilroy, J. C. Needham and Evershed & Vignoles, Ltd. 24,272. October 19th.

Insulating Fittings for Overhead Electric Traction Systems. F. M. Munro and Railless Electric Traction Co. 24,475. October 21st.

Variable-Speed Direct-Current Electric Motors. E. Rosenberg. 24,511. October 21st.

Automatic Instantaneous Switches for Alternating and Direct-Current Circuits. A. M. Taylor. 24,611. October 24th.

Methods of Starting Electrical Induction Motors. G. H. Fletcher and E. A. Gatehouse. 27,119. November 22nd.

Incandescent Electric Lamps. S. Horvath. 27,401. November 24th.

Connection for a Resistance-Measuring Arrangement. Firm of G. A. Schultze. 29,465. December 19th. (December 20th, 1909.)